Dietary studies at the University of Tennessee in 1895 / by Chas. E. Wait.

BULLETIN No. 29.

U. S. DEPARTMENT OF AGRICULTURE.

OFFICE OF EXPERIMENT STATIONS.

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AT THE

UNIVERSITY OF TENNESSEE

IN

1895.

BY

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Professor of Chemistry, University of Tennessee.

WITH COMMENTS BY

W. O. ATWATER and CHAS. D. WOODS.

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LETTER OF TRANSMITTAL.

UNITED STATES DEPARTMENT OF AGRICULTURE,
OFFICE OF EXPERIMENT STATIONS,
Washington, D. C., March 16, 1896.

SIR: I have the honor to transmit herewith a report on dietary studies at the University of Tennessee, Knoxville, in 1895 by Charles E. Wait, Ph. D., professor of chemistry in the university. These investigations constituted a part of the inquiries made during the fiscal year ending June 30, 1895, with the funds appropriated by Congress "to enable the Secretary of Agriculture to investigate and report upon the nutritive value of the various articles and commodities used for human food," and were conducted under the immediate supervision of Prof. W. O. Atwater, special agent in charge of nutrition investigations, in accordance with instructions given by the director of this office.

The accurate dietary studies previously made in the United States had been mostly confined to the New England and other Northern States. In carrying out the provisions of the act above cited, representative localities have been selected in different parts of the country, in order that definite information regarding the food supply and consumption of people living under different conditions might be obtained. The University of Tennessee is located in the center of a large region which has a relatively high elevation and uniform climatic conditions. The modes of life and especially the food habits of the people living in this region are also very much alike.

The University of Tennessee offered special opportunities for the successful prosecution of nutrition inquiries. The university has thoroughly equipped chemical laboratories, and its accomplished professor of chemistry, the author of this report, has devoted himself with great enthusiasm to the prosecution of these inquiries. He was able to secure the services of able and painstaking assistants and the cooperation of a students' club connected with the university. The study of the dietaries of this club was thus made under conditions most favorable for securing definite and accurate results. The other dietary study described in this report was that of a representative mechanic's family living near Knoxville, Tenn. The University of Tennessee cooperated with this Department in the most generous manner, freely giving all the facilities of its laboratories and much of the time of its

professor of chemistry and his assistants. By the expenditure of a small sum of money the Department was thus enabled to obtain a much greater amount of data and results of much more importance and interest than would have otherwise been possible. When it became known in the city of Knoxville and vicinity that such investigations were in progress at the university, the people manifested great interest in them, and the press eagerly sought and widely diffused such general accounts of the nature and purpose of nutrition investigations as were furnished them from time to time.

There is every reason to believe that the published results of these investigations will attract wide attention and that many practical applications of them will be made by the people in the region in which they were conducted. The comments on these investigations made by Professor Atwater and Mr. Woods and appended to Professor Wait's report herewith, indicate the value of the Tennessee investigations when taken in connection with those carried on elsewhere. It should, of course, be constantly kept in mind that investigations carried on for so short a period are necessarily preliminary in their nature and need to be continued before conclusions of definite and permanent value can be reached. The promising results obtained from last year's investigations at the University of Tennessee have led to their continuance by the Department during the present season.

Professor Wait's report and the accompanying comments by the special agents of this Department are respectfully submitted, with the recommendation that they be published as Bulletin No. 29 of this Office.

Respectfully,

A. C. True,
Director.

Hon. J. Sterling Morton,
Secretary.

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DIETARY STUDIES AT THE UNIVERSITY OF TENNESSEE.

The investigations described in this report include four dietary studies made at the University of Tennessee during the first half of 1895. Three of the dietaries are those of a club of students connected with the university, and the fourth is that of a typical mechanic's family in eastern Tennessee. In the prosecution of the work embodied in this report the writer had the valuable assistance of Mr. H. M. Smith, of Middletown, Conn., and of Messrs. C. A. Mooers, J. A. McDonough, C. O. Hill, and J. O. LaBach, of Knoxville, Tenn.

SCOPE AND PLAN OF THE INVESTIGATIONS.

The methods followed in these investigations was essentially the same as those explained in Methods and Results of Investigations on the Chemistry and Economy of Foods (Office of Experiment Stations Bul. No. 21) and in the reports of the Connecticut Storrs Experiment Station for 1891, 1892, 1893, and 1894.

The general plan of the investigation included an account of all food materials of nutritive value in the house at the beginning, that purchased during, and that which remained at the end of the experiment. In addition to this, all the kitchen and table wastes of the food were collected, taken to the laboratory and there weighed and analyzed. The amount of different food materials on hand at the beginning and received during the experiment were added; from this sum the amounts remaining at the end were subtracted. This gave the amount of each material actually used. From the amounts thus obtained and the composition of each material as shown by analysis, the amounts of the nutritive ingredients were estimated. From this again were subtracted the amounts of nutrients in the waste, and thus the amounts of nutrients in the food actually eaten were learned.

An account was kept of all meals, from which was calculated the equivalent number of meals for one man.

COMPOSITION OF TENNESSEE FOOD MATERIALS.

In connection with the dietary studies the following analyses were made of various Tennessee food materials, as well as of five samples of food not produced in Tennessee.

The object of these analyses was twofold—first, to obtain accurate information concerning the amounts of nutrients contained in the food

consumed in the various dietaries; and, second, to make a comparison of the composition of foods produced in Tennessee with similar foods produced in other parts of the country. Being chiefly analyses of native foods, they will necessarily be of much local interest.

METHODS OF ANALYSIS.

The methods employed for the analyses of the specimens of food are the same as those used by Atwater and Woods.[1]

The methods used in the analyses of vegetable foods were practically those recommended by the Association of Official Agricultural Chemists. The following, from the report of the Storrs (Conn.) Experiment Station for 1891, concisely states the methods used in the analyses of meats, fish, eggs, and dairy products:

Separation of flesh from refuse (sampling).—The sample, as received at the laboratory, was weighed; the flesh (edible portion) was then separated from the refuse (skin, bones, etc.), and both portions weighed. There was always a slight loss in the separation, evidently due to evaporation and to small fragments of the tissues that adhered to the hands and to the implements used in preparing the sample. The perfect separation of the flesh from the other tissues was difficult, but the loss resulting from this was small. In sampling the material for analysis, it was finely chopped, either in a tray or in a sausage cutter, and in each case was well mixed.

Water and water-free substance.—The drying was done in ordinary water ovens at a temperature of nominally 100°, but actually 96° and 98° C., as is usual in drying ovens. For each analysis of animal tissues (flesh) one or more samples of 50 to 100 grams of the freshly chopped substance were weighed on a small plate, heated for twenty-four to forty-eight hours, cooled, allowed to stand in the open air for about twenty-four hours, weighed, ground, sifted through a sieve with circular holes 0.5 millimeters in diameter, bottled, and set aside for analysis. In case of fat samples which could not be worked through so fine a sieve, either a coarser sieve was used or the substance was crushed as finely as practicable and bottled without sifting.

For the complete drying, about 2 grams of the partly dried material were dried for three hours. It is extremely difficult to get an absolutely constant weight, though we find that this is in most cases approximately attained in four hours.

Nitrogen, protein, albuminoids, etc.—The nitrogen was determined in the partly dried substance by the method of Kjeldahl. The protein is calculated by multiplying the percentages of nitrogen by 6.25. The nitrogenous matters in meats and fish, i. e., in the materials which have practically no carbohydrates, are also estimated by subtracting the sum of ether extract and ash from the water-free substance, or the sum of water, ether extract, and ash from the fresh substance, the remainder being taken as "albuminoids, etc., by difference." While this is not an absolutely correct measure of the total nitrogenous matter, it is doubtless more nearly so than the product of the nitrogen multiplied by 6.25, and on this account it is used in the tables of composition.

Fat (ether extract).—The fat was extracted with ether in the usual manner. The point at which the extraction is completed is not always easy to determine. For the most part, the extraction was continued for such time as experience indicated to be sufficient, and then the flask was replaced by another and the extraction repeated until the new flask showed no increase in weight.

According to our experience, the fat of many animal tissues is much more difficult

[1] These methods are described in detail in reports of the United States Fish Commission for 1880, 1883, and especially 1888, The American Chemical Journal, Vol. IX, pp. 425–435, and the reports of the Storrs (Conn.) Experiment Station.

to extract than that of most vegetable substances. In general, the greater the percentage of fat in a substance the more difficult is the removal of the last traces. Dried flesh is frequently so hard that the fineness of the material to be extracted seems to be a very important matter.

Ash.—Ash was determined by the method recommended by the Association of Official Agricultural Chemists.

Fuel value—Potential energy.—The food materials were not burned in the calorimeter, but the fuel value of a pound of each of the foods as given in the tables was obtained by multiplying the number of hundredths of a pound of protein and of carbohydrates by 18.6 and the number of hundredths of a pound of fat by 42.2, and taking the sum of these three products as the number of calories of potential energy in the materials.

DESCRIPTION OF SAMPLES.

Beef.—All of the samples were from beef slaughtered in Knoxville for the local markets, and were from Tennessee-grown cattle. The cuts were made in accordance with the usage in this market.

2023. *Pork chops.*—From Tennessee-grown hogs, slaughtered in this market.

2104. *Pork, salt sides.*—Brought to this city from Cincinnati. Probably slaughtered there.

2704. *Chicken.*—Without heart, liver, etc. Common fowl, average size and fatness.

3142. *Canned salmon.*—From Puget Sound. The can contents weighed 480 grams.

69. *Butter.*—Ordinary country butter, produced in this region. The sample analyzed was made up of portions from several different lots of butter.

3577. *Cream cheese.*—American factory cheese.

70, 47. *Milk.*—Furnished by the university farm.

5026. *White corn meal.*—From home-grown corn ground at mills in this city.

5027. *Cracked corn (grits).*—Brought to this market in bulk.

5234. *Bread flour.*—Local, from the city mills.

5406. *Baker's bread.*—"Vienna loaf." Weight, 774 grams (1 pound 11.3 ounces). Price, 10 cents per loaf.

6596. *Cowpeas.*—Grown here.

7068. *Canned peas.*—Marrow fat peas; Munson & Co. brand.

6613. *Potato chips.*—From potatoes grown here.

6569. *Turnip salad greens.*—Taken fresh from the garden.

4052. *Mince-meat.*—Put up in wooden buckets of 20 pounds each. Not local.

The results of the analyses are given in the three tables which follow. In Table 1 there is given the composition of the food materials as found in the market, including both edible portion and refuse; Table 2 shows the composition of the edible portion on the basis of the water content at the time at which the samples were taken, and Table 3 the composition of the water-free substance of the edible portion.

TABLE 1.—*Composition of Tennessee food materials as purchased (including both edible portion and refuse).*

Food materials.	Reference number.	Refuse.	Water.	Protein.	Fat.	Carbohydrates.	Ash.	Fuel value per pound.
ANIMAL FOOD.								
Beef:		*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Calories.*
Chuck	5	24.5	53.7	15.0	6.0	.....	0.8	530
Do	6	22.3	57.0	15.4	4.5	.....	.8	475
Do	7	28.8	51.2	14.3	4.9	.....	.8	470
Do	8	33.1	47.6	13.1	5.5	.....	.7	475
Do	9	27.6	50.7	14.6	6.3	.....	.8	535
Do	10	16.1	58.5	16.9	7.6	.....	.9	635
Do	11	21.6	56.0	15.4	6.2	.....	.8	545
Do	12	18.1	58.3	16.8	5.9	.....	.9	560
Do	17	19.3	56.2	16.0	7.7	.....	.8	620
Do	18	28.1	46.3	14.0	10.9	.....	.7	720
Average	.....	23.9	53.5	15.2	6.6	.....	.8	560
Round steak	207	17.4	59.6	18.3	3.7	.....	1.0	495
Do	218	6.4	65.3	18.9	8.3	.....	1.1	700
Do	219	8.8	65.5	19.8	4.8	.....	1.1	570
Do	220	4.3	68.7	19.7	6.2	.....	1.1	630
Do	221	4.9	67.5	19.1	7.4	.....	1.1	665
Do	222	9.9	63.3	19.7	6.0	.....	1.1	620
Do	223	12.1	60.3	18.4	8.2	.....	1.0	685
Do	224	5.8	66.6	19.9	6.6	.....	1.1	650
Do	225	9.4	62.1	19.4	8.1	.....	1.0	700
Do	226	6.8	66.7	19.4	6.1	.....	1.0	620
Do	227	14.0	59.1	18.3	7.6	.....	1.0	660
Do	228	10.6	62.6	19.3	6.5	.....	1.0	635
Do	229	7.6	63.4	19.9	8.0	.....	1.1	710
Do	247	6.5	63.0	19.1	10.2	.....	1.2	785
Average	.....	8.9	63.8	19.2	7.0	.....	1.1	650
Sirloin steak	53	12.2	59.9	16.9	10.0	.....	1.0	735
Do	54	21.0	52.1	15.4	10.6	.....	.9	735
Do	55	13.4	55.9	16.7	13.0	.....	1.0	860
Do	56	15.6	55.0	16.4	12.1	.....	.9	815
Do	73	16.2	52.8	15.4	13.7	.....	1.9	865
Do	74	6.2	55.6	16.9	20.3	.....	1.0	1,170
Do	75	11.2	52.7	16.6	18.6	.....	.9	1,095
Do	76	22.1	47.5	14.3	15.3	.....	.8	910
Do	77	10.6	55.8	17.7	14.9	.....	1.0	955
Do	78	11.1	53.7	16.3	18.0	.....	.9	1,060
Average	.....	14.0	54.1	16.3	14.6	.....	1.0	920
Pork:								
Chops	2023	10.1	35.7	9.9	43.7	.....	.6	2,030
Salt sides[1]	2104	.....	11.1	7.9	73.2	.....	7.8	3,235
Lard	4040	.....	.....	.....	100.0	.....	.....	4,220
Poultry: Fowl, without heart, liver, etc	2704	32.7	42.2	14.2	10.2	.....	.7	695
Fish: Salmon, canned	3142	14.2	57.5	20.3	5.6	.....	2.4	615
Butter	[2]53	.....	14.7	1.5	81.0	.....	2.8	3,445
Do	[2]69	.....	12.7	1.6	82.9	.....	2.8	3,530
Average	.....	.....	13.7	1.5	82.0	.....	2.8	3,490
Cheese	3577	.....	36.6	31.1	25.0	2.9	4.4	1,690
Milk, whole	[2]47	.....	87.3	3.4	4.0	4.5	.8	315
Do	[2]70	.....	87.9	3.0	3.8	4.6	.7	300
Average	.....	.....	87.6	3.2	3.9	4.6	.7	310
Buttermilk	[2]46	.....	92.6	3.1	.6	3.0	.7	140
Do	[2]71	.....	91.0	2.9	.6	4.8	.7	170
Average	.....	.....	91.8	3.0	.6	3.9	.7	155
VEGETABLE FOOD.								
Corn meal, white	5026	.....	15.5	7.8	3.4	72.3	1.0	1,635
Corn meal grits	5027	.....	12.7	8.7	1.3	76.8	.5	1,645
Rolled oats[1]	5069	.....	8.3	17.6	7.3	65.0	1.8	1,845
Flour, wheat	5234	.....	10.8	10.1	1.0	77.8	.3	1,675
Bread, bakers'	5406	.....	29.2	9.7	2.0	58.1	1.0	1,345
Cowpeas	6596	.....	10.8	22.4	1.6	61.9	3.3	1,635
Peas, canned	7068	.....	85.6	2.2	.2	10.8	1.2	250
Potato chips	6613	.....	1.8	7.6	35.5	50.6	4.5	2,580
Turnip salad greens	6569	.....	84.4	5.2	.8	7.1	2.5	260
Mince-meat[1]	4052	.....	39.7	1.4	1.1	56.7	1.1	1,125

[1] Not produced in Tennessee.

[2] University of Tennessee laboratory numbers.

TABLE 2.—*Composition of fresh, edible portion of Tennessee food materials.*

Food materials.	Reference number.	Water.	Protein.	Fat.	Carbohydrates.	Ash.	Fuel value per pound.
ANIMAL FOOD.							
Beef:		*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Calories.*
Chuck	5	71.0	19.9	8.0	.....	1.1	710
Do	6	73.4	19.8	5.8	.....	1.0	615
Do	7	71.9	20.1	6.9	.....	1.1	665
Do	8	71.1	19.6	8.2	.....	1.1	710
Do	9	70.0	20.1	8.8	.....	1.1	745
Do	10	69.8	20.1	9.0	.....	1.1	755
Do	11	71.5	19.6	7.9	.....	1.0	700
Do	12	71.3	20.5	7.2	.....	1.0	685
Do	17	69.7	19.8	9.5	.....	1.0	770
Do	18	64.3	19.5	15.2	.....	1.0	1,005
Average	.....	70.4	19.9	8.7	.....	1.0	735
Round steak	207	72.2	22.1	4.5	.....	1.2	600
Do	218	69.9	20.1	8.9	.....	1.1	750
Do	219	71.8	21.7	5.3	.....	1.2	630
Do	220	71.7	20.6	6.5	.....	1.2	655
Do	221	71.0	20.1	7.8	.....	1.1	705
Do	222	70.3	21.9	6.6	.....	1.2	685
Do	223	68.6	21.0	9.3	.....	1.1	785
Do	224	70.7	21.1	7.0	.....	1.2	690
Do	225	68.6	21.4	8.9	.....	1.1	775
Do	226	71.4	20.9	6.6	.....	1.1	665
Do	227	68.7	21.3	8.8	.....	1.2	770
Do	228	70.1	21.6	7.2	.....	1.1	705
Do	229	68.6	21.5	8.7	.....	1.2	770
Do	247	67.5	20.4	10.9	.....	1.2	840
Average	.....	70.1	21.1	7.6	.....	1.2	715
Sirloin steak	53	68.2	19.3	11.4	.....	1.1	840
Do	54	65.9	19.6	13.4	.....	1.1	930
Do	55	64.6	19.3	15.0	.....	1.1	990
Do	56	65.2	19.4	14.3	.....	1.1	965
Do	73	63.0	18.4	16.4	.....	2.2	1,035
Do	74	59.3	18.0	21.6	.....	1.1	1,245
Do	75	59.3	18.7	21.0	.....	1.0	1,235
Do	76	60.9	18.4	19.6	.....	1.1	1,170
Do	77	62.5	19.8	16.7	.....	1.0	1,075
Do	78	60.5	18.3	20.2	.....	1.0	1,195
Average	.....	62.9	18.9	17.0	.....	1.2	1,070
Pork:							
Chops	2023	39.7	11.0	48.6	.....	.7	2,255
Salt sides	2104	11.1	7.9	73.2	.....	7.8	3,235
Lard[1]	4040	.....	.....	100.0	.....	.....	4,220
Poultry: Fowl, without heart, liver, etc.	2704	62.8	21.1	15.1	.....	1.0	1,030
Fish: Salmon, canned[1]	3142	67.0	23.7	6.5	.....	2.8	715
Butter	[2]53	14.7	1.5	81.0	.....	2.8	3,445
Do	[2]69	12.7	1.6	82.9	.....	2.8	3,530
Average	.....	13.7	1.5	82.0	.....	2.8	3,490
Cheese	3577	36.6	31.1	25.0	2.9	4.4	1,690
Milk, whole	[2]47	87.3	3.4	4.0	4.5	.8	315
Do	[2]70	87.9	3.0	3.8	4.6	.7	300
Average	.....	87.6	3.2	3.9	4.6	.7	310
Buttermilk	[2]46	92.6	3.1	.6	3.0	.7	140
Do	[2]71	91.0	2.9	.6	4.8	.7	170
Average	.....	91.8	3.0	.6	3.9	.7	155
VEGETABLE FOOD.							
Corn meal, white	5026	15.5	7.8	3.4	72.3	1.0	1,635
Corn meal, grits	5027	12.7	8.7	1.3	76.8	.5	1,645
Rolled oats[1]	5069	8.3	17.6	7.3	65.0	1.8	1,845
Flour, wheat	5234	10.8	10.1	1.0	77.8	.3	1,675
Bread, bakers'	5406	29.2	9.7	2.0	58.1	1.0	1,345
Cowpeas	6596	10.8	22.4	1.6	61.9	3.3	1,635
Peas, canned	7068	85.6	2.2	.2	10.8	1.2	250
Potato chips	6613	1.8	7.6	35.5	50.6	4.5	2,580
Turnip salad greens	6569	84.4	5.2	.8	7.1	2.5	260
Mince-meat[1]	4052	39.7	1.4	1.1	56.7	1.1	1,125

[1] Not produced in Tennessee.

[2] University of Tennessee laboratory numbers.

TABLE 3.—*Composition of water-free substance of edible portion of Tennessee food materials.*

Food materials.	Reference number.	Nitrogen.	Protein.	Fat.	Carbohydrates.	Ash.
ANIMAL FOOD.						
Beef:		*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per ct.*
Chuck	5	11.11	68.6	27.6	.....	3.8
Do	6	12.31	74.4	21.8	.....	3.8
Do	7	11.70	71.5	24.6	.....	3.9
Do	8	10.95	67.8	28.4	.....	3.8
Do	9	10.74	67.0	29.3	.....	3.7
Do	10	10.70	66.6	29.8	.....	3.6
Do	11	10.97	68.8	27.7	.....	3.5
Do	12	11.30	71.4	25.1	.....	3.5
Do	17	10.62	65.3	31.4	.....	3.3
Do	18	8.74	54.6	42.6	.....	2.8
Average	.....	10.91	67.6	28.8	.....	3.6
Round steak	207	12.80	79.5	16.2	.....	4.3
Do	218	10.58	66.8	29.6	.....	3.6
Do	219	12.55	76.9	18.8	.....	4.3
Do	220	12.03	72.8	23.0	.....	4.2
Do	221	12.42	69.3	26.9	.....	3.8
Do	222	11.75	73.7	22.2	.....	4.1
Do	223	10.82	66.9	29.6	.....	3.5
Do	224	11.71	72.0	23.9	.....	4.1
Do	225	10.66	68.2	28.3	.....	3.5
Do	226	11.88	73.1	23.1	.....	3.8
Do	227	10.89	68.1	28.1	.....	3.8
Do	228	11.69	72.2	24.1	.....	3.7
Do	229	11.10	68.5	27.7	.....	3.8
Do	247	10.66	62.8	33.5	.....	3.7
Average	.....	11.47	70.8	25.3	.....	3.9
Sirloin steak	53	9.99	60.7	35.8	.....	3.5
Do	54	9.31	57.5	39.3	.....	3.2
Do	55	8.90	54.5	42.4	.....	3.1
Do	56	8.94	55.7	41.1	.....	3.2
Do	73	8.25	49.7	44.3	.....	6.0
Do	74	7.16	44.2	53.1	.....	2.7
Do	75	7.41	46.0	51.6	.....	2.4
Do	76	7.42	47.1	50.1	.....	2.8
Do	77	8.33	52.8	44.5	.....	2.7
Do	78	7.29	46.3	51.2	.....	2.5
Average	.....	8.30	51.5	45.3	.....	3.2
Pork:						
Chops	2023	3.01	18.2	80.6	.....	1.2
Salt sides	2104	1.48	8.9	82.3	.....	8.8
Lard[1]	4040	.....	.....	100.0	.....	.....
Poultry: Fowl, without heart, liver, etc	2704	9.23	56.7	40.6	.....	2.7
Fish: Salmon, canned[1]	3142	11.43	71.8	19.7	.....	8.5
Butter	53	.....	1.7	95.0	.....	3.3
Do	69	.....	1.8	95.0	.....	3.2
Average	.....	.....	1.7	95.0	.....	3.3
Cheese[1]	3577	7.83	49.1	39.4	4.6	6.9
Milk, whole	47	4.34	26.8	31.5	35.4	6.3
Do	70	3.98	24.8	31.4	38.0	5.8
Average	.....	4.16	25.8	31.5	37.1	5.6
Buttermilk	46	6.71	41.9	8.1	40.5	9.5
Do	71	5.15	32.2	6.7	53.3	7.8
Average	.....	5.93	36.6	7.3	47.6	8.5
VEGETABLE FOOD.						
Corn meal, white	5026	1.47	9.2	4.0	85.6	1.2
Corn meal, grits	5027	1.59	10.0	1.5	88.0	.5
Rolled oats[1]	5069	3.07	19.2	7.9	70.9	2.0
Flour, wheat	5234	1.82	11.3	1.1	87.2	.4
Bread, baker's	5406	2.20	13.7	2.8	82.1	1.4
Cowpeas	6596	4.01	25.1	1.8	69.4	3.7
Peas, canned	7068	2.41	15.3	1.4	75.0	8.3
Potato chips	6613	1.24	7.7	36.2	51.5	4.6
Turnip salad, greens	6569	5.37	33.4	5.1	45.5	16.0
Mince-meat[1]	4052	.38	2.4	1.8	94.0	1.8

[1] Not produced in Tennessee.

COST OF FOOD.

In Table 4 is given, as nearly as possible, the usual cost, in Knoxville, of the various food materials used at the time the dietary studies were made. Where the prices varied, the range is also given.

While it is probable that the college club obtained some foods cheaper than would a private family, the same figures have been used for all studies. These figures have been employed in calculating the cost of the food materials used in the subsequent dietaries.

TABLE 4.—*Showing usual price of the different food materials used in the following dietaries.*

Food materials.	Range in price.	Usual price.	Food materials.	Range in price.	Usual price.
ANIMAL FOOD.			VEGETABLE FOOD—continued.		
Beef:	*Cents.*	*Cents.*		*Cents.*	*Cents.*
Chuck.....per lb..	7 @ 10	8	Crackers, soda.....per lb..	6 @ 10	8
Roast.....do....	.....	8	Hominy.....do....	1½ @ 3	2
Round steak.....do....	5 @ 10	8	Macaroni.....do....	6½ @ 12	8
Sirloin steak.....do....	10 @ 12½	11	Molasses.....do....	.....	3½
Pork:			Sugar.....do....	.....	5
Chops.....per lb..	.....	8	Asparagus.....do....	.....	10
Shoulder.....do....	.....	7	Beans, dry.....do....	.....	4
Fresh ham.....do....	.....	10	Beans, canned.....do....	7½ @ 10	10
Salt pork.....do....	5½ @ 6½	6	Beans, string.....per bu..	25 @150	75
Lard.....do....	7½ @ 8½	8	Cabbage.....per lb..	½ @ 2½	1
Poultry, chicken.....do....	15 @ 25	15	Celery.....do....	.....	5
Fish:			Corn, canned.....do....	5 @ 15	10
Haddock.....per lb..	5 @ 15	12	Lettuce.....per bu..	25 @100	100
Salmon, canned....do....	15 @ 20	15	Onions.....do....	50 @100	100
Eggs (13 to 30 cents dozen), per pound.....	10 @ 20	15	Cowpeas.....do....	50 @150	125
Butter.....per lb..	10 @ 25	20	Peas, canned.....per lb..	12 @ 20	15
Cheese.....do....	12 @ 15	14	Peas, green, in pod...per bu..	25 @100	100
Milk, whole.....per quart..	.....	5	Potatoes.....do....	50 @100	100
Buttermilk.....do....	.....	2	Sweet potatoes.....do....	35 @100	100
Mince-meat, New England, per pound.....	.....	10	Radishes.....per doz..	3 @ 8	5
Mince-meat, Keystone, per lb..	.....	8	Rhubarb.....do....	3 @ 10	3
VEGETABLE FOOD.			Tomatoes, canned....per lb..	6 @ 8	7
Corn meal.....per lb..	.....	1	Turnip salad greens..per bu..	25 @100	100
Wheat flour.....do....	2 @ 2.3	2.2	Turnips.....do....	30 @ 75	75
Rolled oats.....do....	3½ @ 5	4	Apples, evaporated...per lb..	.....	7
Rice.....do....	6 @ 7½	7	Cranberries.....do....	.....	10
Bread.....do....	3½ @ 5	4	Lemons.....do....	.....	8
			Peaches, dried.....do....	.....	10
			Peaches, canned.....do....	12 @ 20	15
			Raisins.....do....	7 @ 15	10

THE DIETARY STUDIES.

The results of the dietary studies are given in the following pages. The tables under each dietary are alike, and one description will answer for all.

EXPLANATION OF THE TABLES.

The figures in the first three columns of the first table of each dietary (Tables 5, 8, 11, and 14) show the percentage composition of the foods used, based upon the condition of the food as it was purchased, including bone or other refuse. The fourth column shows the cost of the food as calculated from the prices given in Table 4, and the remaining columns give the total weight of each kind of food, together with the amounts of the different nutrients, protein, fat, and carbohydrates contained therein.

In all cases where the amount of food was large or of unknown composition, such as native beef, pork, milk, butter, flour, corn meal, etc., samples were analyzed in connection with the dietary study. In all such cases the letter *a* is placed after the name of the food material. These analyses are given in Tables 1 to 3. Where the article was not analyzed its percentage composition was taken from the table of average composition of American foods in Bulletin No. 21 of this Office.

The weights of the dried table and kitchen waste[1] and their composition are given in the last line of the table.

The second table in each dietary (Tables 6, 9, 12, and 15) shows the relative proportions of the several classes of food materials in the dietary and nutrients furnished by each class. It tells its story so plainly as to require little comment.

The last table in each dietary (Tables 7, 10, 13, and 16) gives the nutrients and fuel values of food purchased, in table and kitchen wastes, and in the portion actually eaten. The estimates of animal and vegetable nutrients in the waste are computed as below described. In estimating the fuel values of the nutritive ingredients, the protein and carbohydrates are assumed to contain 4.1 and the fats 9.3 calories of potential energy per gram.

It was not practicable in the collection of the wastes in these experiments to distinguish between that which came from animal and that from vegetable food. It is, however, possible to estimate with more or less accuracy how much of the nutritive ingredients came from the animal and how much from the vegetable foods. As there were practically no carbohydrates in any of the animal foods except milk and cheese, and but little in these, it is reasonably accurate to assume that all the waste carbohydrates came from the vegetable foods. It will also be fairly accurate to assume that there are the same proportions of protein, fat, and carbohydrates in the vegetable waste as in the whole vegetable food purchased. In other words, the amount of vegetable protein and vegetable fat in the waste will bear nearly the same ratio to the total amount of vegetable protein and fat in the food purchased that the carbohydrates of the waste do to the total carbohydrates of the vegetable food. Taking the percentages of the weights of the carbohydrates in the total waste as the measure of the protein and fats in the vegetable wastes, the actual weights of protein and fat in the latter are readily calculated. Subtracting these weights of vegetable protein and fat from the total weight of these ingredients in

[1] The words "refuse" and "waste" are used somewhat indiscriminately. In general, refuse in animal food represents inedible material, although bone, tendon, etc., which are classed as refuse, may be utilized for soup. The refuse of vegetable foods, such as parings, seeds, etc., represent not only inedible material, but also more or less of edible material. The waste includes the edible portion of the food, as pieces of meat, bread, etc., which might be saved, but is actually thrown away with the refuse.

the waste, the remainders give the amounts of animal protein and fats in the whole waste.

Table 17 (p. 29) gives a summary of the results of the four dietary studies.

DIETARY STUDIES OF THE COLLEGE CLUB IN TENNESSEE.

This club consists of 41 students, one of whom acts in the capacity of steward. The steward purchases and provides all food, and as compensation for his services receives his board and a small salary. The average age of these students is 21.6 years; their average weight, 142 pounds.

Of these 41 men 38 are natives of Tennessee, and represent in age, weight, means, etc., the students attending the university.

They are for the most part residents of the country districts and small towns in east Tennessee, sons of farmers of the better class, and live in comfortable circumstances.

The club was organized to meet a demand for cheaper board than could be procured at the university boarding house or in private families.

The rate of board was $2 per week, and all collecting of dues was done by the steward. Payment in advance was an invariable rule, and it is said that under this system no losses have been incurred during the three years' existence of the club.

In addition to the steward, who selected and purchased the food, only one other person was paid for services; this was a woman who was employed to cook and do the laundry work for the table. For this she received $15 per month, besides board and lodging for herself and three children (girls).

The serving of the meals and some assistance in clearing up, etc., was done by students, who received their board as compensation for their service. The dining room, kitchen, and storeroom were in the basement of one of the college dormitories, and were furnished by the university free of rent.

FIRST DIETARY STUDY OF THE COLLEGE CLUB IN TENNESSEE (NO. 39).[1]

The study began January 18, 1895, and continued seven days.

The members of the club and number of meals taken were as follows:

	Meals.
41 men, average 21.6 years, average weight 142 pounds	845
1 woman (21 meals × 0.8 meal of man) equivalent to	17
3 girls (60 meals × 0.7 meal of man) equivalent to	42
Total number of meals taken, equivalent to	904

Equivalent to one man three hundred and one days.

[1] The numbers used for the dietaries refer to laboratory numbers.

TABLE 5.—*Food materials and table and kitchen wastes in dietary study No. 39.*

	Percentage composition.			Total cost.	Weight used.			
	Protein.	Fat.	Carbohydrates.		Total food material.	Nutrients.		
						Protein.	Fat.	Carbohydrates.
ANIMAL FOOD.								
Beef:	*Per ct.*	*Per ct.*	*Per ct.*		*Grams.*	*Grams.*	*Grams.*	*Grams.*
Round steak (*a*)[1]	19.2	7.0	.....	$5.58	31,640	6,075	2,215	.....
Chuck ribs (*a*)[1]	15.2	6.6	.....	4.92	27,890	4,239	1,840	.....
Total	.....	.....	.....	10.50	59,530	10,314	4,055	.....
Pork:								
Shoulder	13.8	25.5	.....	.85	5,590	759	1,403	.....
Ham, fresh	10.7	10.6	.....	2.00	9,070	970	961	.....
Salt, fat (*a*)[1]	7.9	73.2	.....	.56	4,195	331	3,070	.....
Lard	.....	100.0	.....	3.68	20,855	.....	20,855	.....
Total	.....	.....	.....	7.09	39,620	2,060	26,289	.....
Fish, etc.: Salmon, canned (*a*)[1]	20.3	5.6	.....	1.10	3,360	682	188	.....
Eggs	13.1	9.5	.....	2.34	7,085	928	673	.....
Butter (*a*)[1]	1.5	81.0	.....	4.66	10,570	159	8,563	.....
Cheese (*a*)[1]	31.1	25.0	2.9	.53	1,745	542	436	51
Milk, whole (*a*)[1]	3.4	4.0	4.5	1.26	22,950	780	918	1,033
Buttermilk (*a*)[1]	3.1	.6	3.0	.79	35,745	1,108	214	1,072
Mince-meat (*a*)[1]	.8	1.1	57.3	.44	2,495	35	27	1,415
Total animal food	.....	.....	.....	28.71	183,100	16,608	41,363	3,571
VEGETABLE FOOD.								
Cereals, sugar, etc.:								
Corn meal (*a*)[1]	7.8	3.4	72.3	.40	18,140	1,415	617	13,115
Flour, wheat (*a*)[1]	10.1	1.0	77.8	3.51	72,350	7,307	723	56,288
Oats, rolled (*a*)[1]	17.6	7.3	65.0	1.28	14,510	2,554	1,059	9,432
Rice	7.8	.4	79.0	.22	1,460	114	6	1,153
Bread, wheat (*a*)[1]	9.7	2.0	58.1	.81	9,240	895	185	5,368
Crackers, soda	10.3	9.4	70.5	1.60	9,100	937	855	6,415
Sugar, granulated	.....	.....	100.0	3.07	27,900	.....	.....	27,900
Molasses	2.7	.....	68.0	1.62	10,530	284	.....	7,160
Cornstarch	.....	.....	98.0	.10	455	.....	.....	446
Tapioca	.4	.3	87.5	.32	1,445	6	4	1,264
Total	.....	.....	.....	12.93	165,130	13,512	3,449	128,541
Vegetables:								
Beans, dried	22.3	1.8	59.1	.46	2,095	467	38	1,238
Beans, lima	7.1	.7	22.0	.25	2,265	161	16	498
Beans, canned	1.1	.1	3.9	.72	3,290	36	3	128
Corn, canned	2.8	1.3	19.3	2.88	13,070	366	170	2,523
Peas, canned (*a*)[1]	2.2	.2	10.8	1.08	7,230	159	14	781
Cowpeas (*a*)[1]	22.4	1.6	61.9	.11	3,970	889	63	2,456
Potatoes (23 per cent refuse)	2.1	.1	18.0	.31	9,760	205	10	1,757
Potato chips (*a*)[1]	7.0	15.0	64.0	.....	950	66	142	607
Tomatoes, canned	1.2	.2	4.0	1.47	9,525	114	19	381
Turnips	1.0	.1	6.1	.06	3,800	38	4	232
Total	.....	.....	.....	7.34	55,955	2,501	479	10,601
Fruits, nuts, etc.:								
Apples, evaporated	1.4	3.0	57.6	.67	4,380	61	131	2,523
Cranberries	.5	.7	10.1	.45	2,025	10	142	2,045
Peaches, canned	.5	.2	5.3	2.79	8,465	42	17	449
Raisins	2.5	4.7	74.7	.12	555	14	26	415
Total	.....	.....	.....	4.03	15,425	127	316	5,432
Total vegetable food	.....	.....	.....	24.30	236,510	16,140	4,244	144,574
Total food	.....	.....	.....	53.01	419,610	32,748	45,607	148,145
Table and kitchen waste (*a*)	22.6	25.0	48.8	.....	21,430	4,844	5,358	10,459
Fat	.....	100.0	.....	.....	465	.....	465	.....
Total	.....	.....	.....	.....	21,895	4,844	5,823	10,459

[1] Average of the Tennessee analyses reported in the tables above.

TABLE 6.—*Weights and percentages of food materials and nutritive ingredients used in dietary study No. 39.*

Kind of food material.	Weight in grams.				Weight in pounds.				Cost.
	Food material.	Nutrients.			Food material.	Nutrients.			
		Protein.	Fat.	Carbohydrates.		Protein.	Fat.	Carbohydrates.	
FOR CLUB, 7 DAYS.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	
Beef, veal, and mutton	59,530	10,314	4,055	.....	131.3	22.7	8.9	.....	$10.50
Pork, lard, etc	39,620	2,060	26,289	.....	87.4	4.6	58.0	.....	7.09
Fish, etc	3,360	682	188	.....	7.4	1.5	.4	.....	1.10
Eggs	7,085	928	673	.....	15.6	2.1	1.5	.....	2.34
Butter	10,570	159	8,563	.....	23.3	.4	18.9	.....	4.66
Cheese	1,745	542	436	51	3.8	1.2	.9	.1	.53
Milk	22,950	780	918	1,033	50.6	1.7	2.0	2.3	1.26
Buttermilk	35,745	1,108	214	1,072	78.8	2.4	.5	2.4	.79
Mince-meat	2,495	35	27	1,415	5.5	.....	.1	3.1	.44
Total animal food	183,100	16,608	41,363	3,571	403.7	36.6	91.2	7.9	28.71
Cereals, sugars, starches	165,130	13,512	3,449	128,541	364.1	29.8	7.6	283.4	12.93
Vegetables	55,955	2,501	479	10,601	123.3	5.5	1.1	23.3	7.34
Fruits	15,425	127	316	5,432	34.1	.3	.7	12.0	4.03
Total vegetable food	236,510	16,140	4,244	144,574	521.5	35.6	9.4	318.7	24.30
Total food	419,610	32,748	45,607	148,145	925.2	72.2	100.6	326.6	53.01
PER MAN PER DAY.									
Beef, veal, and mutton	198	34	13	.....	.44	.07	.03	.....	.....
Pork, lard, etc	132	7	87	.....	.29	.02	.19	.....	.....
Fish, etc	11	2	1	.....	.02	.....	.....	.....	.....
Eggs	23	3	2	.....	.05	.01	.....	.....	.....
Butter	35	.....	29	.....	.08	.....	.06	.....	.....
Cheese	6	2	1	.....	.01	.....	.....	.....	.....
Milk	76	3	3	3	.17	.01	.01	.01	.....
Buttermilk	119	4	1	4	.26	.01	.....	.01	.....
Mince-meat	8	.....	.....	5	.02	.....	.....	.01	.....
Total animal food	608	55	137	12	1.34	.12	.29	.03	.10
Cereals, sugars, starches	549	45	11	427	1.21	.10	.02	.94	.....
Vegetables	186	9	2	35	.41	.02	.01	.08	.....
Fruits	51	.....	1	18	.11	.....	.....	.04	.....
Total vegetable food	786	54	14	480	1.73	.12	.03	1.06	.08
Total food	1,394	109	151	492	3.07	.24	.32	1.09	.18
PERCENTAGES OF TOTAL FOOD.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*					*Per ct.*
Beef, veal, and mutton	14.2	31.5	8.9	.....	.....	.....	.....	.....	19.8
Pork, lard, etc	9.4	6.3	57.6	.....	.....	.....	.....	.....	13.4
Fish, etc	.8	2.1	.4	.....	.....	.....	.....	.....	2.1
Eggs	1.7	2.8	1.5	.....	.....	.....	.....	.....	4.4
Butter	2.5	.5	18.9	.....	.....	.....	.....	.....	8.8
Cheese	.4	1.7	.9	.....	.....	.....	.....	.....	1.0
Milk	5.5	2.4	2.0	.7	.....	.....	.....	.....	2.4
Buttermilk	8.5	3.4	.5	.7	.....	.....	.....	.....	1.5
Mince-meat	.6	.....	.....	1.0	.....	.....	.....	.....	.8
Total animal food	43.6	50.7	90.7	2.4	.....	.....	.....	.....	54.2
Cereals, sugars, starches	39.4	41.3	7.6	86.8	.....	.....	.....	.....	24.4
Vegetables	13.3	7.6	1.0	7.1	.....	.....	.....	.....	13.8
Fruits	3.7	.4	.7	3.7	.....	.....	.....	.....	7.6
Total vegetable food	56.4	49.3	9.3	97.6	.....	.....	.....	.....	45.8
Total food	100.0	100.0	100.0	10.00	.....	.....	.....	.....	100.0

TABLE 7.—*Nutrients and potential energy in food purchased, rejected, and eaten in dietary study No. 39.*

Kind of food material.	Cost.	Nutrients.			Fuel value.
		Protein.	Fat.	Carbohydrates.	
		Grams.	*Grams.*	*Grams.*	*Calories.*
Food purchased:					
Animal	$28.71	16,593	41,363	3,586	467,410
Vegetable	24.30	16,140	4,244	144,574	698,400
Total	53.01	32,733	45,607	148,160	1,165,810
Waste:					
Animal	.....	3,677	5,516	.....	66,370
Vegetable	.....	1,167	307	10,459	50,520
Total	.....	4,844	5,823	10,459	116,890
Food actually eaten:					
Animal	.....	12,916	35,847	3,586	401,040
Vegetable	.....	14,973	3,937	134,115	647,880
Total	.....	27,889	39,784	137,701	1,048,920
PER MAN PER DAY.					
Food purchased:					
Animal	.10	55	137	12	1,550
Vegetable	.08	54	14	480	2,320
Total	.18	109	151	492	3,870
Waste:					
Animal	.....	12	18	.....	220
Vegetable	.....	4	1	35	170
Total	.....	16	19	35	390
Food actually eaten:					
Animal	.....	43	119	12	1,330
Vegetable	.....	50	13	445	2,150
Total	.....	93	132	457	3,480
PERCENTAGES OF TOTAL FOOD PURCHASED.					
Food purchased:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Animal	54.2	50.7	90.7	2.4	40.1
Vegetable	45.8	49.3	9.3	97.6	59.9
Total	100.0	100.0	100.0	100.0	100.0
Waste:					
Animal	.....	11.3	12.1	.....	5.7
Vegetable	.....	3.5	.7	7.1	4.3
Total	.....	14.8	12.8	7.1	10.0
Food actually eaten:					
Animal	.....	39.4	78.6	2.4	34.4
Vegetable	.....	45.8	8.6	90.5	55.6
Total	.....	85.2	87.2	92.9	90.0

SECOND DIETARY OF THE COLLEGE CLUB (NO. 40).

This study was commenced upon the completion of the one just described, and lasted fourteen days. Similar records were kept, and the conditions were the same as in that study.

An additional record, however, was made of the temperature.

This was furnished by the Signal Service office at this station, and is as follows: Maximum temperature, +50° F.; minimum, −7° F. Mean of recorded temperatures was +29° F. In this period occurred about the coldest weather experienced during the winter.

The study began January 25, 1895, and continued fourteen days.

The club and number of meals taken were as follows:

	Meals.
41 men, average age 21.6 years	1,747
1 woman (43 meals × 0.8 meal of man) equivalent to	34
3 girls (125 meals × 0.7 meal of man) equivalent to	88
Total number of meals taken equivalent to	1,869

Equivalent to one man six hundred and twenty-three days.

TABLE 8.—*Food materials and table and kitchen wastes in dietary study No. 40.*

Kind of food material.	Percentage composition.			Total cost.	Weight used.			
	Protein.	Fat.	Carbohydrates.		Total food material.	Nutrients.		
						Protein.	Fat.	Carbohydrates.
ANIMAL FOOD.								
Beef:	*Per ct.*	*Per ct.*	*Per ct.*		*Grams.*	*Grams.*	*Grams.*	*Grams.*
Chuck (*a*)	15.0	6.0	.....	$0.89	5,045	757	303	.....
Do	15.4	4.5	.....	.96	5,445	838	245	.....
Do	14.3	4.9	.....	.96	5,470	782	268	.....
Do	13.1	5.5	.....	.95	5,385	706	296	.....
Do	14.6	6.3	.....	.91	5,190	757	327	.....
Do	15.2	7.6	.....	.94	5,355	814	407	.....
Do	16.9	7.6	.....	.96	5,430	918	413	.....
Do	15.4	6.2	.....	.96	5,445	838	337	.....
Do	16.8	5.9	.....	.97	5,485	921	324	.....
Do	14.0	10.9	.....	.96	5,430	760	592	.....
Do	16.0	7.7	.....	.86	4,905	785	378	.....
Total	.....	.....	.....	10.32	58,585	8,876	3,890	.....
Round steak (*a*)	18.9	8.3	.....	.79	4,495	849	373	.....
Do	19.8	4.8	.....	.40	2,265	449	109	.....
Do	19.7	6.2	.....	.96	5,445	1,072	337	.....
Do	19.1	7.4	.....	.48	2,720	520	201	.....
Do	18.3	3.7	.....	.51	2,890	529	107	.....
Do	19.7	5.9	.....	.40	2,270	447	134	.....
Do	18.4	8.2	.....	.48	2,750	506	226	.....
Do	19.9	6.6	.....	.26	1,475	293	97	.....
Do	19.4	8.1	.....	.97	5,500	1,067	446	.....
Do	19.1	10.2	.....	.49	2,795	533	285	.....
Do	19.4	6.1	.....	.98	5,540	1,075	338	.....
Do	18.3	7.6	.....	.41	2,325	425	177	.....
Do	19.3	6.5	.....	.50	2,835	547	184	.....
Do	19.9	8.0	.....	.38	2,155	429	172	.....
Total	.....	.....	.....	8.01	45,460	8,741	3,186	.....
Sirloin (*a*)	16.9	10.0	.....	.55	2,270	383	227	.....
Do	15.4	13.7	.....	.43	1,760	271	241	.....
Do	15.4	10.6	.....	.42	1,755	271	186	.....
Do	16.7	13.0	.....	.56	2,325	388	302	.....
Do	16.9	20.3	.....	.67	2,750	465	558	.....
Do	16.6	18.6	.....	.85	3,530	586	657	.....
Do	14.3	15.3	.....	.68	2,790	399	427	.....
Do	17.7	14.9	.....	.78	3,205	567	477	.....
Do	16.3	18.0	.....	.69	2,835	462	510	.....
Do	16.4	12.1	.....	.81	3,345	549	405	.....
Total	.....	.....	.....	6.44	26,565	4,341	3,990	.....
Total beef	.....	.....	.....	24.77	130,610	21,958	11,611	.....
Pork:								
Salt, fat (*a*)	7.9	73.2	.....	.94	7,090	560	5,188	.....
Chops (*a*)	9.9	43.7	.....	.19	1,075	107	471	.....
Lard (*a*)	.....	100.0	.....	6.68	30,790	.....	30,790	.....
Total	.....	.....	.....	7.81	38,955	667	36,449	.....
Poultry: Fowl (*a*)	14.2	10.2	.....	9.53	28,805	4,090	2,938	.....
Fish, etc.: Salmon, canned (*a*)	20.3	5.6	.....	3.33	10,085	2,047	565	.....
Eggs	13.1	9.5	.....	1.74	5,260	689	500	.....
Butter (*a*)	1.5	81.0	.....	10.86	24,620	369	19,944	.....
Cheese (*a*)	31.1	25.0	2.9	1.23	3,985	1,239	996	116
Milk (*a*)	3.4	4.0	4.5	2.95	53,580	1,822	2,143	2,411
Buttermilk (*a*)	3.1	.6	3.0	1.04	47,160	1,462	283	1,415
Mince-meat, New England	9.3	1.5	62.0	.42	1,900	177	28	1,178
Mince-meat, Keystone (*a*)	.8	1.1	57.3	.83	4,735	66	52	2,685
Total animal food	.....	.....	.....	64.51	349,695	34,586	74,964	7,805

TABLE 8.—*Food materials and table and kitchen wastes in dietary study No. 40*—Cont'd.

Kind of food material.	Percentage composition.			Total cost.	Weight used.			
	Protein.	Fat.	Carbohydrates.		Total food material.	Nutrients.		
						Protein.	Fat.	Carbohydrates.
VEGETABLE FOOD.								
Cereals, sugar, etc.:	*Per ct.*	*Per ct.*	*Per ct.*		*Grams.*	*Grams.*	*Grams.*	*Grams.*
Corn meal (*a*)	7.8	3.4	72.3	$1.33	60,415	4,712	2,054	43,679
Flour, wheat (*a*)	10.1	1.0	77.8	5.01	103,465	10,450	1,035	80,494
Oatmeal (*a*)	17.6	7.3	65.0	2.15	24,380	4,291	1,780	15,848
Rice	7.8	.4	79.0	.47	3,030	236	12	2,394
Hominy	8.2	.6	78.9	2.36	11,795	967	71	9,306
Bread, white (*a*)	9.7	2.0	58.1	2.07	23,430	2,273	469	13,613
Crackers	10.3	9.4	70.5	5.26	29,850	3,075	2,806	21,046
Sugar, granulated	.....	.....	100.0	3.08	69,800	.....	.....	69,800
Molasses	2.7	.....	68.0	1.08	14,285	386	.....	9,714
Total	.....	.....	.....	22.81	340,450	26,390	8,227	265,894
Vegetables:								
Beans, canned	1.1	.1	3.9	.97	4,395	48	4	171
Beans, dried	22.3	1.8	59.1	.36	4,055	894	73	2,397
Cabbage	1.8	.3	4.9	.34	15,310	276	46	750
Celery	1.4	.1	3.0	.17	1,505	21	2	45
Corn, canned	2.8	1.3	19.3	4.74	21,490	602	279	4,148
Onions	1.5	.4	8.9	.02	1,000	15	4	89
Peas, canned (*a*)	2.2	.2	10.8	4.25	12,845	283	26	1,387
Cowpeas (*a*)	22.4	1.6	61.9	.08	3,515	787	56	2,176
Potatoes (23 per cent refuse)	2.1	.1	18.0	1.47	49,365	1,037	49	8,885
Potato chips (*a*)	7.0	15.0	64.0	.....	2,030	142	304	1,299
Sweet potatoes (23 per cent refuse)	1.8	.7	27.1	.48	16,650	300	117	4,512
Tomatoes, canned	1.2	.2	4.0	3.08	19,975	240	40	799
Total	.....	.....	.....	15.96	152,135	4,645	1,000	26,658
Fruits, nuts, etc.:								
Apples, evaporated	1.4	3.0	57.6	2.74	17,775	249	533	10,238
Cranberries	.5	.7	10.1	.67	3,020	15	21	305
Lemons	.7	.6	5.8	.17	950	7	6	55
Raisins	2.5	4.7	74.7	.39	1,755	44	82	1,311
Peaches, canned	.5	.2	5.3	1.49	4,495	22	9	238
Total	.....	.....	.....	5.46	27,995	337	651	12,147
Total vegetable food	.....	.....	.....	44.23	520,580	31,372	9,878	304,699
Total food	.....	.....	.....	108.74	870,275	65,958	84,842	312,504
Table and kitchen wastes (*a*)	21.9	22.7	51.7	.....	36,200	7,930	8,232	18,730
Fat	.....	100.0	.....	.....	800	.....	800	.....
Total	.....	.....	.....	.....	37,000	7,930	9,032	18,730

TABLE 9.—*Weights and percentages of food materials and nutritive ingredients used in dietary study No. 40.*

Kind of food material.	Weight in grams.				Weight in pounds.				Cost.
	Food material.	Nutrients.			Food material.	Nutrients.			
		Protein.	Fat.	Carbohydrates.		Protein.	Fat.	Carbohydrates.	
FOR CLUB, 14 DAYS.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	
Beef, veal, and mutton	130,610	21,958	11,066	.....	287.9	48.4	24.4	.....	$24.77
Pork, lard, etc	38,955	667	36,449	.....	85.9	1.5	80.3	.....	7.81
Poultry	28,805	4,090	2,938	.....	63.5	9.0	6.5	.....	9.53
Fish, etc	10,085	2,047	565	.....	22.2	4.5	1.2	.....	3.33
Eggs	5,260	689	500	.....	11.6	1.5	1.1	.....	1.74
Butter	24,620	369	19,944	.....	54.3	.8	44.0	.....	10.86
Cheese	3,985	1,239	996	116	8.8	2.7	2.2	.3	1.23
Milk	53,580	1,822	2,143	2,411	118.1	4.0	4.7	5.3	2.95
Buttermilk	47,160	1,462	283	1,415	104.0	3.2	.6	3.1	1.04
Mince-meat	6,635	243	80	3,863	14.6	.5	.2	8.6	1.25
Total animal food	349,695	34,586	74,964	7,805	770.9	76.2	165.2	17.2	64.51

TABLE 9.—*Weights and percentages of food materials, etc.*—Continued.

Kind of food material.	Weight in grams.				Weight in pounds.				Cost.
	Food material.	Nutrients.			Food material.	Nutrients.			
		Protein.	Fat.	Carbohydrates		Protein.	Fat.	Carbohydrates.	
	Grams.	*Grams.*	*Grams.*	*Grams.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	
Cereals, sugars, starches	340,450	26,390	8,227	265,894	750.6	58.2	18.2	586.0	$2.811
Vegetables	152,135	4,645	1,000	26,658	335.4	10.2	2.2	58.9	25.96
Fruits	27,995	337	651	12,147	61.7	.7	1.4	26.8	5.46
Total vegetable food	520,580	31,372	9,878	304,699	1,147.7	69.1	21.8	671.7	44.23
Total food	870,275	65,958	84,842	312,504	1,918.6	145.3	187.0	688.9	108.74
PER MAN PER DAY.									
Beef, veal, and mutton	210	35	17	.....	.46	.08	.04	.....	.....
Pork, lard, etc	63	1	59	.....	.14	.....	.13	.....	.....
Poultry	46	7	5	.....	.10	.02	.01	.....	.....
Fish, etc	16	4	1	.....	.04	.01	.....	.....	.....
Eggs	8	1	1	.....	.02	.....	.....	.....	.....
Butter	40	1	32	.....	.09	.....	.07	.....	.....
Cheese	6	2	2	.....	.01	.....	.....	.....	.....
Milk	86	3	3	4	.19	.01	.01	.01	.....
Buttermilk	76	2	.....	2	.17	.....	.....	.....	.....
Mince-meat	10	.....	.....	7	.02	.....	.....	.02	.....
Total animal food	561	56	120	13	1.24	.12	.26	.03	.10
Cereals, sugars, starches	547	42	13	427	1.20	.09	.03	.94	.....
Vegetables	244	7	2	43	.54	.02	.01	.10	.....
Fruits	45	1	1	19	.10	.....	.....	.04	.....
Total vegetable food	836	50	16	489	1.84	.11	.04	1.08	.07
Total food	1,397	106	136	502	3.08	.23	.30	1.11	.17
PERCENTAGES OF TOTAL FOOD.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*					*P. ct.*
Beef, veal, and mutton	15.0	33.3	13.0	.....	.....	.....	.....	.....	22.8
Pork, lard, etc	4.5	1.0	43.0	.....	.....	.....	.....	.....	7.2
Poultry	3.3	6.2	3.4	.....	.....	.....	.....	.....	8.8
Fish, etc	1.2	3.1	.7	.....	.....	.....	.....	.....	3.0
Eggs	.6	1.0	.6	.....	.....	.....	.....	.....	1.6
Butter	2.8	.6	23.5	.....	.....	.....	.....	.....	10.0
Cheese	.4	1.9	1.2	.....	.....	.....	.....	.....	1.1
Milk	6.2	2.8	2.5	.8	.....	.....	.....	.....	2.7
Buttermilk	5.4	2.2	.3	.5	.....	.....	.....	.....	1.0
Mince-meat	.8	.3	.1	1.2	.....	.....	.....	.....	1.1
Total animal food	40.2	52.4	88.3	2.5	.....	.....	.....	.....	59.3
Cereals, sugars, starches	39.1	40.0	9.7	85.1	.....	.....	.....	.....	21.0
Vegetables	17.5	7.1	1.2	8.5	.....	.....	.....	.....	14.7
Fruits	3.2	.5	.8	3.9	.....	.....	.....	.....	5.0
Total vegetable food	59.8	47.6	11.7	97.5	.....	.....	.....	.....	40.7
Total food	100.0	100.0	100.0	100.0	.....	.....	.....	.....	100.0

TABLE 10.—*Nutrients and potential energy in food purchased, rejected, and eaten in dietary study No. 40.*

Kind of food material.	Cost.	Nutrients.			Fue valuel.
		Protein.	Fat.	Carbohydrates.	
		Grams.	*Grams.*	*Grams.*	*Calories.*
Food purchased:					
Animal	$64.51	34,558	74,964	7,832	870,970
Vegetable	44.23	31,372	9,878	304,699	1,469,750
Total	108.74	65,930	84,842	312,532	2,340,720
Waste:					
Animal	.....	6,002	8,425	.....	102,960
Vegetable	.....	1,928	607	18,730	90,340
Total	.....	7,930	9,032	18,730	193,300

TABLE 10.—*Nutrients and potential energy in food purchased, rejected, etc.*—Continued.

Kind of food material.	Cost.	Nutrients.			Fue value.
		Protein.	Fat.	Carbo-hydrates.	
Food actually eaten:		*Grams.*	*Grams.*	*Grams.*	*Calories.*
Animal	.....	28,556	66,539	7,833	768,010
Vegetable	.....	29,444	9,271	285,969	1,379,410
Total	.....	58,000	75,810	293,802	2,147,420
PER MAN PER DAY.					
Food purchased:					
Animal	$0.10	56	120	13	1,400
Vegetable	.07	50	16	489	2,360
Total	.17	106	136	502	3,760
Waste:					
Animal	.....	10	13	.....	165
Vegetable	.....	3	1	30	145
Total	.....	13	14	30	310
Food actually eaten:					
Animal	.....	46	107	13	1,235
Vegetable	.....	47	15	459	2,215
Total	.....	93	122	472	3,450
PERCENTAGES OF TOTAL FOOD PURCHASED.					
Food purchased:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Animal	59.3	52.4	88.3	2.5	37.2
Vegetable	40.7	47.6	11.7	97.5	62.8
Total	100.0	100.0	100.0	100.0	100.0
Waste:					
Animal	.....	9.1	9.9	.....	4.4
Vegetable	.....	2.9	.7	6.0	3.8
Total	.....	12.0	10.6	6.0	8.2
Food actually eaten:					
Animal	.....	43.3	78.4	2.5	32.8
Vegetable	.....	44.7	11.0	91.5	59.0
Total	.....	88.0	89.4	94.0	91.8

THIRD DIETARY OF THE COLLEGE CLUB (NO. 41).

This study, intentionally delayed until the warm weather, was commenced on May 4 and lasted seven days. The weather record was as follows: Maximum, 88° F.; minimum, 55° F.; mean of recorded temperatures, 72° F. The conditions differ only slightly from those in the preceding study; the number of men was increased to 43; age about 22 years, weight about 143 pounds.

The study began May 4, 1895, and continued seven days.
The club and number of meals taken were as follows:

	Meals.
43 men, average age about 22 years	918
2 women (34 meals × 0.8 meal of man), equivalent to	27
3 girls (60 meals × 0.7 meal of man), equivalent to	42
Total number of meals taken equivalent to	987

Equivalent to one man three hundred and twenty-nine days.

TABLE 11.—*Food materials and table and kitchen wastes in dietary study No. 41.*

Kind of food material.	Percentage composition.			Total cost.	Weight used.			
	Protein.	Fat.	Carbohydrates.		Total food material.	Nutrients. Protein.	Fat.	Carbohydrates.
ANIMAL FOOD.								
Beef:	*Per ct.*	*Per ct.*	*Per cent.*		*Grams.*	*Grams.*	*Grams.*	*Grams.*
Chuck rib (*a*)[1]	15.2	6.8	.....	$4.58	26,025	3,956	1,718	.....
Loin steak (*a*)[1]	16.3	14.6	.....	.65	3,715	606	542	.....
Round steak (*a*)[1]	19.2	7.0	.....	3.72	21,150	4,061	1,480	.....
Total	.....	.....	.....	8.95	50,890	8,623	3,740	.....
Pork:								
Salt, fat (*a*)[1]	7.9	73.2	.....	.81	6,125	484	4,483	.....
Lard	.....	100.0	.....	3.06	17,465	.....	17,465	.....
Total	.....	.....	.....	3.87	23,590	484	21,948	.....
Poultry: Fowl (*a*)[1]	14.2	10.2	.....	4.13	12,500	1,775	1,275	.....
Fish: Salmon, canned (*a*)[1]	20.3	5.6	.....	.95	2,885	586	161	.....
Eggs	13.1	9.5	.....	6.91	20,950	274	199	.....
Butter (*a*)[1]	1.5	81.0	.....	6.08	13,820	207	11,195	.....
Cheese (*a*)[1]	31.1	25.0	2.9	.94	3,060	952	765	89
Milk, whole (*a*)[1]	3.4	4.0	4.5	2.32	42,100	1,431	1,684	1,895
Buttermilk (*a*)[1]	3.1	.6	3.0	.94	42,740	1,325	256	1,282
Mince-meat, New England	4.0	2.2	67.4	.17	765	31	17	515
Total animal food	.....	.....	.....	35.26	213,300	15,688	41,240	3,781
VEGETABLE FOOD.								
Cereals, sugar, etc.:								
Corn meal (*a*)[1]	7.8	3.4	72.3	.38	17,405	1,358	592	12,585
Flour, wheat (*a*)[1]	10.1	1.0	77.8	3.01	62,825	6,345	628	48,877
Oatmeal (*a*)[1]	17.6	7.3	65.0	.97	11,000	1,936	803	7,150
Bread (*a*)[1]	9.7	2.0	58.1	1.82	20,725	2,010	414	12,041
Crackers, soda	10.3	9.4	70.5	1.32	7,485	771	704	5,277
Macaroni	11.7	1.6	72.9	.08	455	53	7	332
Sugar, granulated	.....	.....	100.0	4.01	36,515	.....	.....	36,515
Molasses	2.7	.....	68.0	3.00	39,055	1,054	.....	26,552
Total	.....	.....	.....	14.59	195,465	13,527	3,148	149,329
Vegetables:								
Asparagus	1.8	.2	3.3	.50	2,240	40	4	74
Beans, dried	22.3	1.8	59.1	.31	3,570	796	64	2,110
Beans, string	2.2	.4	9.4	.78	11,765	259	47	1,106
Corn, canned	2.8	1.3	19.3	3.05	13,865	388	180	2,676
Greens	3.8	.9	8.9	.13	5,785	220	52	515
Lettuce	1.1	.3	2.7	.11	5,075	56	15	137
Onions	1.5	.4	8.9	.32	14,645	220	59	1,303
Potatoes (23 per cent refuse)	2.1	.1	18.0	.74	26,090	548	26	4,696
Peas (30 per cent refuse)	4.4	.5	16.1	.21	5,595	246	28	901
Radishes	1.0	.1	4.6	.30	2,720	27	3	125
Rhubarb	.4	.4	2.2	.49	7,485	30	30	165
Tomatoes, canned	1.2	.2	4.0	1.02	6,635	80	13	265
Total	.....	.....	.....	7.96	105,470	2,910	521	14,073
Fruits, nuts, etc.:								
Cranberries	.5	.7	10.1	.58	2,665	13	19	269
Raisins	2.5	4.7	74.7	.28	1,275	32	60	952
Dried fruit	1.4	3.0	57.6	3.13	14,215	199	426	8,187
Total	.....	.....	.....	3.99	18,155	244	505	9,408
Total vegetable food	.....	.....	.....	26.54	319,090	16,681	4,174	172,810
Total food	.....	.....	.....	61.80	532,390	32,369	45,414	176,591
Table and kitchen waste (*a*)	20.5	19.2	56.4	.....	15,815	3,242	3,036	8,920
Clear fat	.....	100.0	.....	.....	33	.....	33	.....
Total	.....	.....	.....	.....	15,848	3,242	3,069	8,920

[1] Average of Tennessee analyses.

TABLE 12.—*Weights and percentages of food materials and nutritive ingredients used in dietary study No. 41.*

Kind of food material.	Weight in grams.				Weight in pounds.				Cost.
	Food material.	Nutrients.			Food material.	Nutrients.			
		Protein.	Fat.	Carbohydrates.		Protein.	Fat.	Carbohydrates.	
FOR CLUB, 7 DAYS.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	
Beef, veal, and mutton	50,890	8,623	3,740	.....	112.2	19.0	8.3	.....	$8.95
Pork, lard, etc	23,590	484	21,948	.....	52.0	1.1	48.4	.....	3.87
Poultry	12,500	1,775	1,275	.....	27.5	3.9	2.8	.....	4.13
Fish, etc	2,885	586	161	.....	6.4	1.3	.4	.....	.95
Eggs	20,950	274	199	.....	46.2	.6	.4	.....	6.91
Butter	13,820	207	11,195	.....	30.5	.5	24.7	.....	6.08
Cheese	3,060	952	765	89	6.7	2.1	1.7	.2	.94
Milk	42,100	1,431	1,684	1,895	92.8	3.1	3.7	4.2	2.32
Buttermilk	42,740	1,325	256	1,282	94.2	2.9	.6	2.8	.94
Mince-meat	765	31	17	515	1.7	.1	.....	1.1	.17
Total animal food	213,300	15,688	41,240	3,781	470.2	34.6	91.0	8.3	35.26
Cereals, sugars, starches	195,465	13,527	3,148	149,329	430.9	29.8	6.9	329.2	14.59
Vegetables	105,470	2,910	521	14,073	232.6	6.4	1.2	31.0	7.96
Fruits	18,155	244	505	9,408	40.0	.5	1.1	20.8	3.99
Total vegetable food	319,090	16,681	4,174	172,810	703.5	36.7	9.2	381.0	26.54
Total food	532,390	32,369	45,414	176,591	1,173.7	71.3	100.2	389.3	61.80
PER MAN PER DAY.									
Beef, veal, and mutton	154	26	11	.....	.34	.06	.03	.....	.....
Pork, lard, etc	72	1	67	.....	.16	.....	.15	.....	.....
Poultry	38	5	4	.....	.08	.01	.01	.....	.....
Fish, etc	9	2	.....	.....	.02	.....	.....	.....	.....
Eggs	64	1	1	.....	.14	.....	.....	.....	.....
Butter	42	1	34	.....	.09	.....	.08	.....	.....
Cheese	9	3	2	.....	.02	.01	.....	.....	.....
Milk	128	4	5	6	.28	.01	.01	.01	.....
Buttermilk	130	4	1	4	.29	.01	.....	.01	.....
Mince-meat	2	.....	.....	2	.01	.....	.....	.01	.....
Total animal food	648	47	125	12	1.43	.10	.28	.03	.11
Cereals, sugars, starches	595	41	10	454	1.32	.09	.02	1.00	.....
Vegetables	320	9	2	43	.70	.02	.01	.09	.....
Fruits	55	1	1	28	.12	.....	.....	.06	.....
Total vegetable food	970	51	13	525	2.14	.11	.03	1.15	.08
Total food	1,618	98	138	537	3.57	.21	.31	1.18	.19
PERCENTAGES OF TOTAL FOOD.	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*					*Per ct.*
Beef, veal, and mutton	9.6	26.7	8.2	.....	.....	.....	.....	.....	14.5
Pork, lard, etc	4.4	1.5	48.3	.....	.....	.....	.....	.....	6.3
Poultry	2.4	5.5	2.8	.....	.....	.....	.....	.....	6.7
Fish, etc	.5	1.8	.4	.....	.....	.....	.....	.....	1.5
Eggs	3.9	.8	.4	.....	.....	.....	.....	.....	11.2
Butter	2.6	.7	24.7	.....	.....	.....	.....	.....	9.8
Cheese	.6	2.9	1.7	.....	.....	.....	.....	.....	1.5
Milk	7.9	4.4	3.7	1.1	.....	.....	.....	.....	3.8
Buttermilk	8.0	4.1	.6	.7	.....	.....	.....	.....	1.5
Mince-meat	.2	.1	.....	.3	.....	.....	.....	.....	.3
Total animal food	40.1	48.5	90.8	2.1	.....	.....	.....	.....	57.5
Cereals, sugars, starches	36.7	41.8	6.9	84.6	.....	.....	.....	.....	23.6
Vegetables	19.8	9.0	1.2	8.0	.....	.....	.....	.....	12.9
Fruits	3.4	.7	1.1	5.3	.....	.....	.....	.....	6.4
Total vegetable food	59.9	51.5	9.2	97.9	.....	.....	.....	.....	42.5
Total food	100.0	100.0	100.0	100.0	.....	.....	.....	.....	100.0

TABLE 13.—*Nutrients and potential energy in food purchased, rejected, and eaten in dietary study No. 41.*

Kind of food material.	Cost.	Nutrients.			Fuel value.
		Protein.	Fat.	Carbohydrates.	
Food purchased:		*Grams.*	*Grams.*	*Grams.*	*Calories.*
Animal	$35.26	15,688	41,240	3,781	463,350
Vegetable	26.04	16,681	4,174	172,810	815,730
Total	61.30	32,369	45,414	176,591	1,279,080
Waste:					
Animal	.....	2,381	2,854	.....	36,300
Vegetable	.....	861	215	8,920	42,100
Total	.....	3,242	3,069	8,920	78,400
Food actually eaten:					
Animal	.....	13,307	38,386	3,781	427,050
Vegetable	.....	15,820	3,959	163,890	773,630
Total	.....	29,127	42,345	167,671	1,200,680
PER MAN PER DAY.					
Food purchased:					
Animal	.11	47	125	12	1,400
Vegetable	.08	51	13	525	2,480
Total	.19	98	138	537	3,880
Waste:					
Animal	.....	8	9	.....	115
Vegetable	.....	2	1	27	130
Total	.....	10	10	27	245
Food actually eaten:					
Animal	.....	39	116	12	1,285
Vegetable	.....	49	12	498	2,350
Total	.....	88	128	510	3,635
PERCENTAGES OF TOTAL FOOD PURCHASED.					
Food purchased:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Animal	57.1	48.5	90.8	2.1	36.2
Vegetable	42.9	51.5	9.2	97.9	63.8
Total	100.0	100.0	100.0	100.0	100.0
Waste:					
Animal	.....	7.4	6.3	.....	2.9
Vegetable	.....	2.6	.5	5.1	3.2
Total	.....	10.0	6.8	5.1	6.1
Food actually eaten:					
Animal	.....	41.1	84.5	2.1	33.3
Vegetable	.....	48.9	8.7	92.8	60.6
Total	.....	90.0	93.2	94.9	93.9

DIETARY OF THE MECHANIC'S FAMILY IN TENNESSEE.

The difficulty experienced in obtaining suitable and typical families for dietary studies has long been appreciated. The personal, or home, factor enters to such an extent that very few families seem disposed to have their bill of fare, or cost of living, publicly known.

Very fortunately, in this instance, the consent of a mechanic with a large family (four men, three women, and one child) was secured. All the family were natives of the immediate locality.

Of the four men three were hard workers at manual labor, the other a young man of 18 years, attending school, and working out of school hours.

The three women were of mature age, and did the cooking and the household work of the family.

The study began April 2, 1895, and continued seven days.

The members of the family and number of meals taken were as follows:

	Meals.
4 men, average age 30 years	83
3 women, average age 33 years (62 meals × 0.8 meal of man), equivalent to	50
1 child, 1 year old (21 meals × 0.3 meal of man), equivalent to	6
Total number of meals taken equivalent to	139

Equivalent to one man forty-six days.

TABLE 14.—*Food materials and table and kitchen wastes in dietary study No. 42.*

Kind of food material.	Percentage composition.			Total cost.	Weight used.			
	Protein.	Fat.	Carbohydrates.		Total food material.	Nutrients.		
						Protein.	Fat.	Carbohydrates.
ANIMAL FOOD.								
Beef:	*Per ct.*	*Per ct.*	*Per ct.*		*Grams.*	*Grams.*	*Grams.*	*Grams.*
Round steak (*a*) [1]	19.2	7.0	.....	$0.45	2,580	495	181	.....
Roast (*a*) [1]	15.2	7.6	.....	.70	3,995	607	304	.....
Total	.....	.....	.....	1.15	6,575	1,102	485	.....
Pork:								
Chops (*a*) [1]	9.9	43.7	.....	.39	4,535	449	1,982	.....
Salt sides (*a*) [1]	7.9	73.2	.....	.66	5,020	397	3,673	.....
Lard	.....	100.0	.....	.42	2,355	.....	2,355	.....
Total	.....	.....	.....	1.47	11,910	846	8,010	.....
Fish: Haddock	8.2	.2	.....	.31	1,190	98	2	.....
Eggs	13.1	9.5	.....	1.02	3,090	405	293	.....
Butter (*a*)	1.6	82.9	.....	.42	965	15	800	.....
Milk, whole (*a*) [1]	3.0	3.8	4.6	.27	4,875	146	185	224
Buttermilk (*a*) [1]	2.9	.6	4.8	.21	9,525	276	57	457
Total animal food	.....	.....	.....	4.85	38,130	2,888	9,832	681
VEGETABLE FOOD.								
Cereals, sugar, etc.:								
Corn meal (*a*) [1]	7.8	3.4	72.3	.13	5,895	460	200	4,262
Flour, wheat (*a*) [1]	10.1	1.0	77.8	.69	14,460	1,460	145	11,249
Oat flakes (*a*) [1]	17.6	7.3	65.0	.02	255	45	18	166
Sugar, granulated	.....	.....	100.0	.14	1,245	.....	.....	1,245
Total	.....	.....	.....	.98	21,855	1,965	363	16,922
Vegetables:								
Beans, dried	22.3	1.8	59.1	.10	1,135	253	20	671
Potatoes (18.5 per cent refuse)	2.1	.1	18.0	.11	4,255	89	4	766
Sweet potatoes	1.5	.6	23.1	.03	1,190	18	7	275
Turnip salad (*a*)	5.2	.8	7.1	.08	3,685	192	29	262
Total	.....	.....	.....	.32	10,265	552	60	1,974
Fruits, nuts, etc.:								
Apples, dried	1.4	3.0	57.6	.14	905	13	27	521
Peaches, dried	2.9	.....	63.3	.25	1,135	33	.....	718
Peaches, canned	.5	.2	5.3	.73	2,300	12	4	122
Total	.....	.....	.....	1.12	4,340	58	31	1,361
Total vegetable food	.....	.....	.....	2.42	36,460	2,575	454	20,257
Total food	.....	.....	.....	7.27	74,590	5,463	10,286	20,938
Table and kitchen waste (*a*)	13.3	18.7	64.4	.....	3,115	414	583	2,006
Clear fat	.....	100.0	.....	.....	72	.....	72	.....
Total	.....	.....	.....	.....	3,187	414	655	2,006

[1] Average of Tennessee analyses.

TABLE 15.—*Weights and percentages of food materials and nutritive ingredients used in dietary study No. 42.*

Kind of food material.	Weight in grams.				Weight in pounds.				Cost.
	Food material.	Nutrients.			Food material.	Nutrients.			
		Protein.	Fat.	Carbohydrates.		Protein.	Fat.	Carbohydrates.	
FOR FAMILY, 7 DAYS.	*Grams.*	*Grams.*	*Grams.*	*Grams.*	*Lbs.*	*Lbs.*	*Lbs.*	*Lbs.*	
Beef, veal, and mutton	6,575	1,102	485	.....	14.5	2.4	1.1	.....	$1.15
Pork, lard, etc	11,910	846	8,010	.....	26.2	1.9	17.7	.....	1.47
Fish, etc	1,190	98	2	.....	2.6	.2	.....	.....	.31
Eggs	3,090	405	293	.....	6.8	.9	.6	.....	1.02
Butter	965	15	800	.....	2.1	.....	1.8	.....	.42
Milk	4,875	146	185	224	10.8	.3	.4	.5	.27
Buttermilk	9,525	276	57	457	21.0	.6	.1	1.0	.21
Total animal food	38,130	2,888	9,832	681	84.0	6.3	21.7	1.5	4.85
Cereals, sugars, starches	21,855	1,965	363	16,922	48.2	4.4	.8	37.3	.98
Vegetables	10,265	552	60	1,974	22.6	1.2	.1	4.3	.32
Fruits	4,340	58	31	1,361	9.6	.1	.1	3.0	1.12
Total vegetable food	36,460	2,575	454	20,257	80.4	5.7	1.0	44.6	2.42
Total food	74,590	5,463	10,286	20,938	164.4	12.0	22.7	46.1	7.27
PER MAN PER DAY.									
Beef, veal, and mutton	143	24	11	.....	.32	.05	.02	.....	.....
Pork, lard, etc	259	18	174	.....	.57	.04	.39	.....	.....
Fish, etc	26	2	.....	.....	.06	.01	.....	.....	.....
Eggs	67	9	7	.....	.15	.02	.01	.....	.....
Butter	21	1	17	.....	.05	.....	.04	.....	.....
Milk	106	3	4	5	.23	.01	.01	.01	.....
Buttermilk	207	6	1	10	.45	.01	.....	.02	.11
Total animal food	829	63	214	15	1.83	.14	.47	.03	.....
Cereals, sugars, starches	475	43	8	368	1.05	.09	.02	.82	.....
Vegetables	223	12	1	41	.49	.03	.....	.09	.....
Fruits	95	1	1	29	.21	.....	.....	.06	.....
Total vegetable food	793	56	10	438	1.75	.12	.02	.97	.05
Total food	1,622	119	224	453	3.58	.26	.49	1.00	.16
PERCENTAGES OF TOTAL FOOD.	*Per cent.*	*Per cent*	*Per cent*	*Per cent.*					*Per ct.*
Beef, veal, and mutton	8.8	20.2	4.7	.....	.....	.....	.....	.....	15.8
Pork, lard, etc	16.0	15.5	77.9	.....	.....	.....	.....	.....	20.2
Fish, etc	1.6	1.8	.....	.....	.....	.....	.....	.....	4.3
Eggs	4.1	7.4	2.9	.....	.....	.....	.....	.....	14.0
Butter	1.3	.3	7.8	.....	.....	.....	.....	.....	5.8
Milk	6.5	2.7	1.8	1.1	.....	.....	.....	.....	3.7
Buttermilk	12.8	5.0	.6	2.2	.....	.....	.....	.....	2.9
Total animal food	51.1	52.9	95.7	3.3	.....	.....	.....	.....	66.7
Cereals, sugar, starches	29.3	36.0	3.5	81.2	.....	.....	.....	.....	13.5
Vegetables	13.8	10.0	.5	9.0	.....	.....	.....	.....	4.4
Fruits	5.8	1.1	.3	6.5	.....	.....	.....	.....	15.4
Total vegetable food	48.9	47.1	4.3	96.7	.....	.....	.....	.....	33.3
Total food	100.0	100.0	100.0	100.0	.....	.....	.....	.....	100.0

TABLE 16.—*Nutrients and potential energy in food purchased, rejected, and eaten in dietary study No. 42.*

Kind of food material.	Cost.	Nutrients.			Fuel value.
		Protein.	Fat.	Carbohydrates.	
		Grams.	*Grams.*	*Grams.*	*Calories.*
Food purchased:					
Animal	$4.85	2,888	9,832	681	106,070
Vegetable	2.42	2,575	454	20,257	97,830
Total	7.27	5,463	10,286	20,938	203,900
Waste:					
Animal	.....	158	610	.....	6,320
Vegetable	.....	256	45	2,006	9,690
Total	.....	414	655	2,006	16,010
Food actually eaten:					
Animal	.....	2,730	9,222	681	99,750
Vegetable	.....	2,319	409	18,251	88,140
Total	.....	5,049	9,631	18,932	187,890
PER MAN PER DAY.					
Food purchased:					
Animal	.11	63	214	15	2,310
Vegetable	.05	56	10	440	2,125
Total	.16	119	224	455	4,435
Waste:					
Animal	.....	3	13	.....	135
Vegetable	.....	6	1	43	210
Total	.....	9	14	43	345
Food actually eaten:					
Animal	.....	60	201	15	2,175
Vegetable	.....	50	9	397	1,915
Total	.....	110	210	412	4,090
PERCENTAGES OF TOTAL FOOD PURCHASED.					
Food purchased:	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Animal	66.7	52.9	95.7	3.3	52.1
Vegetable	33.3	47.1	4.3	96.7	47.9
Total	100.0	100.0	100.0	100.0	100.0
Waste:					
Animal	.....	3.0	6.0	.....	3.1
Vegetable	.....	4.6	.4	9.6	4.8
Total	.....	7.6	6.4	9.6	7.9
Food actually eaten:					
Animal	.....	49.9	89.7	3.3	49.0
Vegetable	.....	42.5	3.9	87.1	43.1
Total	.....	92.4	93.6	90.4	92.1

TABLE 17.—*Summary of the protein and potential energy per man per day contained in the food purchased, wasted, and eaten in the preceding studies, and the cost of the same.*

	Cost.			Protein.			Fuel value.		
	Total.	Per cent of total animal.	Per cent of total vegetable.	Total.	Per cent of total animal.	Per cent of total vegetable.	Total.	Per cent of total animal.	Per cent of total vegetable.
PER MAN PER DAY.									
Food purchased:	*Cents.*	*Per ct.*	*Per ct.*	*Grams.*	*Per ct.*	*Per ct.*	*Calories.*	*Per ct.*	*Per ct.*
Dietary No. 39	18	54.2	45.8	109	50.7	49.3	3,870	40.1	59.9
Dietary No. 40	17	59.3	40.7	106	52.4	47.6	3,760	37.2	62.8
Dietary No. 41	19	57.1	42.9	98	48.5	51.5	3,880	36.2	63.8
Average 39, 40, and 41	18	56.9	43.1	104	50.5	49.5	3,835	37.8	62.2
Dietary No. 42	16	66.7	33.3	119	52.9	47.1	4,435	52.1	47.9
Waste:									
Dietary No. 39	2¼	9.9	3.3	16	11.3	3.5	390	5.7	4.3
Dietary No. 40	1⅓	7.2	2.5	13	9.1	2.9	310	4.4	3.8
Dietary No. 41	1½	6.0	2.3	10	7.4	2.6	245	2.9	3.2
Average 39, 40, and 41	1¾	7.7	2.7	13	9.3	3.0	315	4.3	3.8
Dietary No. 42	1½	4.2	4.6	9	3.0	4.6	345	3.1	4.8
Food eaten:									
Dietary No. 39	15¾	44.3	42.5	93	39.4	45.8	3,480	34.4	55.6
Dietary No. 40	15⅔	52.1	38.2	93	43.3	44.7	3,450	32.8	59.0
Dietary No. 41	17½	51.1	40.6	88	41.1	48.9	3,635	33.3	60.6
Average 39, 40, and 41	16½	49.2	40.4	91	43.6	44.1	3,520	33.5	58.4
Dietary No. 42	14½	62.5	28.7	110	49.9	42.5	4,090	49.0	43.1

DISCUSSION OF RESULTS.

First dietary of the college club.—In this study particular attention is directed to the results under Table 7—food purchased, wasted, and eaten per man per day.

Of the total protein purchased 12.1 per cent was lost in the animal and 0.7 per cent in the vegetable waste. In other words, 12.8 per cent of the most expensive nutrients in the food were thrown away. It is scarcely probable that an appreciable amount of animal protein would be wasted in the form of eggs, cheese, butter, or milk. We may therefore assume that all of the animal protein in the waste comes from meats and fish. Under this assumption the club threw away 28.2 per cent of the protein purchased in their meat. In other words, out of every dollar's worth of meat and fish purchased they threw 28 cents' worth into the garbage.

While there may be many causes leading to this excessive waste in the animal protein, it must in large part be due to the quality of the meat provided and to the way in which it is served.

Second dietary of the college club.—This study was begun immediately at the close of the preceding one, but continued longer. All the analyses previously reported were made in connection with this dietary, almost all the meats being analyzed. These same analyses were taken for the average composition of similar foods in all the dietary studies made here.

The amount of waste was less in this study than in the previous one, there being only 10.6 per cent of the total protein wasted. Of this 9.9

per cent was from the animal food, and, making the same assumption as before, for every dollar's worth of meat and fish purchased 21 cents' worth was thrown away. The total cost of the waste was 11.2 per cent of that of the whole food.

The amounts of the nutrients eaten during the time of this study were practically the same as before, there being, however, a little less of fat and a litttle more of carbohydrates.

Third dietary of the college club.—In this study, owing to the warmer weather, less meat and more fresh vegetables were eaten, thus reducing the amount of protein in the food and increasing the weight of the carbohydrates. The fuel value of the food eaten was also increased slightly over that in the preceding studies.

The percentage of meat wasted was the same as in the second study, namely, 21 cents' worth in every dollar's worth purchased. The total waste, however, was less than before, being but 8.2 per cent of the total cost and 10 per cent of the total protein.

In the following table the two winter dietaries are compared with the one made in the spring:

TABLE 18.—*Winter and spring dietaries of the college club compared.*

	Cost.	Protein.	Fat.	Carbohydrates.	Fuel value.
PER MAN PER DAY.					
Average of two winter dietaries:	*Cents.*	*Grams.*	*Grams.*	*Grams.*	*Calories.*
Purchased	17.5	107	144	497	3,815
Waste	2.0	14	17	33	350
Eaten	15.5	93	127	464	3,465
Spring dietary:					
Purchased	19.0	98	138	537	3,880
Waste	1.5	10	10	27	245
Eaten	17.5	88	128	510	3,635
Average of three dietaries:					
Purchased	18.0	104	142	510	3,835
Waste	2.0	13	15	30	315
Eaten	16.0	91	127	480	3,520

Dietary of the mechanic's family.—There is a general impression that a very excessive amount of fat is eaten in this part of the country. The three dietaries of the college club did not bear out this belief, the amount of beef consumed being nearly twice that of pork. In the mechanic's family, however, 32 per cent of the animal food purchased was pork, including steaks, sides, and lard. Of the meat (including fish) purchased over 60 per cent was pork.

The amount of waste protein is very small, being but 7.6 per cent of the total protein in the food purchased. Less than 8 cents' worth of meat per dollar's worth was thrown away. In spite of great excess of fat in this study, a smaller per cent was wasted than of protein.

The following table gives a summary of the protein and potential energy in the food eaten and wasted, and its cost, in the dietaries studied here. It needs no explanation.

TABLE 19.—*Summary of the three dietaries of the college club and the mechanic's family; protein and potential energy per man per day contained in the food purchased, wasted, and eaten, and the cost of the same.*

	Total cost.	Total protein.	Total potential energy.	Proportion of meat wasted.	Proportion of total cost—		Proportion of total protein—		Proportion of total fuel value—	
					In animal food.	In vegetable food.	In animal food.	In vegetable food.	In animal food.	In vegetable food.
PER MAN PER DAY.										
Food purchased:	*Cents.*	*Grams.*	*Calories.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*	*Per ct.*
First dietary of club	18	109	3,870	.....	54.2	45.8	50.7	49.3	40.1	59.9
Second dietary of club	17	106	3,760	.....	59.3	40.7	52.4	47.6	37.2	62.8
Third dietary of club	19	98	3,880	.....	57.1	42.9	48.5	51.5	36.2	63.8
Average	18	104	3,835	.....	56.9	43.1	50.5	49.5	37.8	62.2
Dietary of a mechanic's family	16	119	4,435	.....	66.7	33.3	52.9	47.1	52.1	47.9
Waste:										
First dietary of club	2.8	16	390	28.2	9.9	3.3	11.3	3.5	5.7	4.3
Second dietary of club	1.5	13	310	20.9	8.7	2.5	9.1	2.9	4.4	3.8
Third dietary of club	1.5	10	245	20.8	6.0	2.2	7.4	2.6	2.9	3.2
Average	2.0	13	315	23.3	8.2	2.7	9.3	3.0	4.3	3.8
Dietary of a mechanic's family	1.5	9	345	7.7	4.2	4.6	3.0	4.6	3.1	4.8
Food eaten:										
First dietary of club	15.5	93	3,480	.....	44.3	42.5	39.4	45.8	34.4	55.6
Second dietary of club	15.5	93	3,410	.....	50.6	38.2	43.3	44.7	32.8	59.0
Third dietary of club	17.5	88	3,635	.....	51.1	40.7	41.1	48.9	33.3	60.6
Average	16.0	91	3,520	.....	48.7	40.4	43.6	44.1	33.5	58.4
Dietary of a mechanic's family	14.5	110	4,090	.....	62.5	28.7	49.9	42.5	49.0	43.1

COMMENTS ON THE DIETARY STUDIES AT THE UNIVERSITY OF TENNESSEE.

By W. O. Atwater and Chas. D. Woods.

These investigations are parts of a more general inquiry into the food economy of the people of the United States. Only the beginnings have been made, but enough information has already accumulated to indicate with a fair degree of probability what the character of some of the conclusions will be. A comparison of the results of the investigations at Knoxville with some of those obtained elsewhere will help to show not only a marked agreement in some important respects, and thus confirm some of these conclusions, but will serve to bring out some of the special characteristics of the food consumption of the students of the University of Tennessee and of the mechanic's family whose dietaries were studied, and of the food materials of the region.

COMPARISON OF DIETARIES OF COLLEGE STUDENTS IN TENNESSEE, MISSOURI, AND CONNECTICUT.

It will be interesting to compare the results of the studies of the three dietaries of the student's club at the University of Tennessee with those of investigations of other college boarding clubs. The only studies of this character (adult male students) made in the United States and at present available, so far as we are aware, are several series of dietary studies of students' clubs at Wesleyan University, Middletown, Conn., and at the University of Missouri, Columbia, Mo.

The results of the investigations in Connecticut have been published in the Reports of the Storrs (Conn.) Agricultural Experiment Station for the years 1891–1894, and are summarized in Bulletin No. 21 of this Office.[1] The actual analyses of the food consumed were made in only two studies. The averages of these two are cited below.

The dietaries at the University of Missouri, which cooperated with this Department in studies on the food and nutrition of man, were conducted by the late Prof. H. B. Gibson. The figures given below are taken from Professor Gibson's report, which still awaits publication. They represent the averages of two studies of dietaries of the same club.

The students in the University of Tennessee were mostly residents of that State, a large number coming from the eastern portion. It would seem fair to assume, therefore, that their eating habits would be more or less such as they had acquired at home, although the diet would

[1] Methods and Results of Investigations on the Chemistry and Economy of Food, pp. 155–198 (see especially pages 182 and 186).

probably be somewhat modified by proximity to the markets in Knoxville. As the management of the club and the diet was in the hands of the students, and its immediate direction was assigned by them to one of their number, it is probable that the kinds and amounts of food were in accordance with their previously acquired habits and tastes. In the same way it seems fair to assume that the food consumed by the students in the University of Missouri would represent more or less closely in both kinds and amounts the dietary habits of young men belonging to the class of families in that State whose sons go to college. The students at Wesleyan University were mostly from New England and the neighboring States. In the original report of the investigations, which were carried out by the writers, the students were in like manner assumed to be typical of intelligent families in that section of the country. The cost of the board was considerably more in the clubs at Wesleyan than in those of the two other colleges.

It is true that the young men represent only one class of members of families, and that the number of observations were too few and the periods too short to allow of extended generalizations. With these reservations, the following comparisons will be of interest and not without decided value. And they certainly emphasize the need of a large number of accurate observations in these and similar directions.

KINDS OF FOOD IN THE DIETARIES OF DIFFERENT COLLEGE CLUBS COMPARED.

The kinds of food and proportions in which like foods entered into the dietaries of the college clubs in these different localities varied considerably. Only a general comparison of the classes of foods themselves can be made. The following tabulation (Table 20) gives the average weights of the different classes of food materials purchased per man per day by the college clubs in the three places:

TABLE 20.—*Weights of different classes of foods purchased per man per day in dietaries of college clubs in Tennessee, Missouri, and Connecticut.*

	Tennessee.	Missouri.	Connecticut.	Tennessee.	Missouri.	Connecticut.
	Grams.	*Grams.*	*Grams.*	*Pounds.*	*Pounds.*	*Pounds.*
Beef, veal, and mutton	187	160	245	0.41	0.35	0.54
Pork	89	113	91	.20	.25	.20
Poultry	28	12	6	.06	.03	.01
Fish	12	6	24	.03	.01	.05
Eggs	32	55	35	.07	.12	.08
Butter	39	27	60	.09	.06	.13
Cheese	7	7	.....	.01	.02	.....
Milk	97	680	457	.21	1.50	1.01
Buttermilk	108	.....	.....	.24	.....	.....
Total animal food	599	1,060	918	1.32	2.34	2.02
Cereals, sugar, etc.[1]	564	524	361	1.25	1.15	.80
Vegetables	250	266	189	.55	.59	.42
Fruits	50	51	89	.11	.11	.19
Total vegetable food	864	841	639	1.91	1.85	1.41
Total food	1,463	1,901	1,557	3.23	4.19	3.43

[1] The cereal products were mainly wheat flour, with more or less corn meal and oatmeal.

Among the special differences in the classes of foods the following are noticeable:

The Connecticut college clubs used much more of beef, veal, and mutton than the others. The weight of pork is a little misleading, as the pork used by the Connecticut club was almost entirely fresh pork and included but little lard. In the Missouri and Tennessee dietaries the pork was chiefly salt pork and lard.

That more poultry and eggs were used in Tennessee and Missouri than in Connecticut illustrates one of the characteristic differences in the dietaries of the different regions.

The comparatively small amount of milk used in the Tennessee dietary is noteworthy. It amounted to less than one-half of a pound per man per day, while in Connecticut 1 pound and in Missouri 1½ pounds per man per day were used.

The large amount of milk in the Missouri and Connecticut dietaries increases the total weight of the animal food very considerably, but with due allowance for this, much more of animal food was purchased by the students in Conneticut and Missouri than in Tennessee. This small proportion of animal food in the Tennessee dietary is balanced by a correspondingly large amount of vegetable foods and especially of cereals.

NUTRIENTS IN DIETARIES OF DIFFERENT COLLEGE CLUBS COMPARED.

Different as were the classes and kinds of food used, it is possible to compare with reasonable accuracy the weights of nutrients in the food purchased, wasted, and eaten per man per day by the different clubs. This is done in Table 21, which follows. The standard suggested on page 213 of Bulletin No. 21 of this Office, above referred to, for a man at light muscular work is appended for comparison. It is, of course, understood that this standard is not final, but may be modified as information on the subject accumulates.

TABLE 21.—*Comparison of nutrients in food purchased, wasted, and eaten in dietaries of college clubs in Tennessee, Missouri, and Connecticut.*

	Protein.	Fats.	Carbohydrates.	Fuel values.	Nutritive ratio.
FOOD PURCHASED.					
In Tennessee:	*Grams.*	*Grams.*	*Grams.*	*Calories.*	*1:*
Animal	53	127	12	1,450	.....
Vegetable	52	14	498	2,390	.....
Total	105	141	510	3,840	.....
In Missouri:					
Animal	63	169	25	1,930	.....
Vegetable	44	7	425	1,990	.....
Total	107	176	450	3,920	.....
In Connecticut:					
Animal	75	162	21	1,900	.....
Vegetable	38	8	338	1,690	.....
Total	113	170	359	3,590	.....

TABLE 21.—*Comparison of nutrients in food purchased, etc.*—Continued.

	Protein.	Fats.	Carbohydrates.	Fuel values.	Nutritive ratio.
FOOD WASTED.					
In Tennessee:	*Grams.*	*Grams.*	*Grams.*	*Calories.*	*1:*
Animal	10	13	.....	170	.....
Vegetable	3	1	31	150	.....
Total	13	14	31	320	.....
In Missouri:					
Animal	6	13	.....	145	.....
Vegetable	5	3	40	215	.....
Total	11	16	40	360	.....
In Connecticut:					
Animal	12	31	.....	340	.....
Vegetable	2	.....	23	110	.....
Total	14	31	23	450	.....
FOOD EATEN.					
In Tennessee:					
Animal	43	114	12	1,280	.....
Vegetable	49	13	467	2,240	.....
Total	92	127	479	3,520	8.3
In Missouri:					
Animal	57	156	25	1,785	.....
Vegetable	39	4	385	1,775	.....
Total	96	160	410	3,560	8.0
In Connecticut:					
Animal	63	131	21	1,560	.....
Vegetable	36	8	315	1,580	.....
Total	99	139	336	3,140	6.7
Average of all:					
Animal	53	131	19	1,505	.....
Vegetable	42	9	400	1,915	.....
Total	95	140	419	3,420	7.8
Standard for a man with light muscular work (Atwater)	112	.....	.....	3,000	5.5

The dietary standard suggested for a day's food for a man with light muscular work calls for 112 grams of protein and sufficient fats and carbohydrates in addition to make the whole fuel value 3,000 calories. It will be observed that as measured by this standard the food eaten in all three of the college clubs was deficient in protein and had an excess of the nutrients which serve simply as fuel and tend to make rations wide, namely, carbohydrates and fats. This departure from a well-balanced ration seems to be more marked in the Southern than in the Northern dietaries. The food eaten per man per day in the college clubs in Connecticut furnished 99 grams of protein and had a fuel value of 3,140 calories and a nutritive ratio of 1 to 6.7. In Missouri the protein in the food eaten was 96 grams, the fuel value 3,560 calories, and the nutritive ratio 1 to 8. In Tennessee there were only 92 grams of protein, with a fuel value of 3,920 calories and a nutritive ratio of 1 to 8.3.

These studies accord with the considerable number already made in the United States in three important particulars: The quantity of

protein is small, the fuel values are high, and the nutritive ratios are wide.

The nutritive ratio seems to be wider—in other words, the excess of fats, starch, and sugar seems to be greater—in the food eaten in the South than in the North. This latter statement is based upon general observation rather than upon the especial studies here described. The relatively small amounts of the leaner meats, as beef and veal, and of the nitrogenous vegetable foods, as beans and peas, used in the Southern States, and the large proportions of fatty and starchy foods, as pork and corn meal, in the diet of that region, are matters of most common observation, with which the results of these particular studies entirely accord.

This fact of large consumption of fuel ingredients and small consumption of flesh formers by no means proves a physiological demand. A discussion of this subject will be more appropriate in another place, and it will suffice here to suggest that the evident one-sidedness of the diet of the country at large, and especially in the South, is due to the prevailing conditions, and does not express a fundamental law of nature. The remedy for this is to be found in a more careful selection of food, and in the production of leaner meats and of more nitrogenous vegetable products. In the South this means the use of less pork and more beef, less corn meal and more of wheat, oatmeal, and peas.[1]

PROTEIN IN THE DIETARIES OF DIFFERENT COLLEGE CLUBS COMPARED.

In Table 22, which follows, there are given the weights and percentages of protein in the animal, vegetable, and total food purchased in the dietaries of college clubs in Tennessee, Missouri, and Connecticut:

TABLE 22.—*Weights and percentages of protein in animal, vegetable, and total food purchased, wasted, and eaten in dietaries of college clubs in Tennessee, Missouri, and Connecticut.*

	Tennessee.		Missouri.		Connecticut.	
	Grams.	*Per cent.*	*Grams.*	*Per cent.*	*Grams.*	*Per cent.*
Animal food:						
Purchased	53	50	63	59	75	67
Wasted	10	9	6	6	12	11
Eaten	43	41	57	53	63	56
Vegetable food:						
Purchased	52	50	44	41	38	33
Wasted	3	3	5	5	2	2
Eaten	49	47	39	36	36	31
Total food:						
Purchased	105	100	107	100	113	100
Wasted	13	12	11	11	14	13
Eaten	92	88	96	89	99	87

As noted above, the food eaten was deficient in protein, and most markedly so in the case of the Tennessee dietary. The table points out the sources of the protein. In the Tennessee dietaries about half came from the vegetable foods. In the Missouri dietaries 59 per cent came

[1]See article on "An error in our agricultural production, and the remedy," Experiment Station Record, Vol. III, pp. 672–683.

from the animal food and 41 per cent from the vegetable, while in those in Connecticut 67 per cent of the protein was furnished by the animal food and only 33 by the vegetable food. Inasmuch as animal protein is in general better utilized by the body than that of vegetable origin, the deficiency of protein is the greater and the dietary is the more out of balance the larger the proportion of vegetable protein. The case is made still worse by the fact that much of the protein is wasted, and the waste comes largely in all three cases from the animal food. In the Connecticut dietaries 87 per cent, in Tennessee 88 per cent, and in Missouri 89 per cent of the protein purchased was actually eaten. The rest, which was thrown away, came mostly from the meats, which furnish protein in its most digestible and useful forms.

Table 23 shows the fuel values of the food purchased, wasted, and eaten in dietaries of the college clubs. As in the figures for protein in the previous table, not only the amounts, as shown by the numbers of calories in each of the three portions of the food, but also the percentages of the total fuel value are shown:

TABLE 23.—*Calories and percentages of fuel value in food purchased, wasted, and eaten in dietaries of college clubs in Tennessee, Missouri, and Connecticut.*

	Tennessee.		Missouri.		Connecticut.	
	Calories.	Per cent.	Calories.	Per cent.	Calories.	Per cent.
Animal food:						
Purchased	1,450	38	1,930	49	1,900	53
Wasted	170	4	145	3	340	9
Eaten	1,280	34	1,785	46	1,560	44
Vegetable food:						
Purchased	2,390	62	1,990	51	1,690	47
Wasted	150	4	215	6	110	3
Eaten	2,240	58	1,775	45	1,580	44
Total food:						
Purchased	3,840	100	3,920	100	3,590	100
Wasted	320	8	360	9	450	12
Eaten	3,520	92	3,560	91	3,140	88

It will be noticed that the sources of the fuel value are very nearly the reverse, so far as animal and vegetable foods are concerned, of the sources of protein. In Tennessee only 38 per cent of the fuel value was contained in the animal food and 62 per cent in the vegetable. In Missouri it was about equally divided between the animal and vegetable food, while in Connecticut 53 per cent of the fuel value was furnished by the animal and 47 per cent by vegetable foods. In Tennessee 8 per cent, in Missouri 9 per cent, and in Connecticut 12 per cent of the fuel value of the total food purchased was thrown away in the table waste.

COMPARISON OF DIETARIES OF MECHANICS' FAMILIES IN TENNESSEE, INDIANA, NEW JERSEY, AND CONNECTICUT.

In the following pages the results of the dietary study of the mechanic's family at Knoxville are compared with the results of several like investigations elsewhere. The latter include one study made

at Lafayette, Ind., one at New Brunswick, N. J., and eight made at Middletown, Conn. The dietary studies at Middletown were published in the Reports of the Storrs (Conn.) Agricultural Experiment Station for the years 1891–1894. The families were those of four carpenters, two masons, one blacksmith, and one machinist. They were all in comfortable circumstances. The study in Indiana was conducted by Prof. W. E. Stone, of Purdue University. The family was that of a tinner in comfortable circumstances. The one in New Jersey was made by Prof. E. B. Voorhees, director of the New Jersey Agricultural Experiment Station. The family was that of a mechanic who was employed in a paper mill. His work consisted in handling and shipping paper and was quite severe. The studies in Lafayette and New Brunswick were made in cooperation with this Department, and the results still await publication.

The standard suggested on page 213 of Bulletin 21 of this Office, previously referred to, for a man at moderate muscular work is appended for comparison. This standard is tentative and intended to express, as nearly as the limited data now available will allow, the needs of an average man doing a fair amount of moderately hard manual labor.

It should be noted that the quantities of food and nutrients in this, as in other tables, are calculated per man per day.

TABLE 24.—*Comparison of nutrients in food purchased, wasted, and eaten in dietaries of mechanics' families in Tennessee, Indiana, New Jersey, and Connecticut.*

	Protein.	Fats.	Carbohydrates.	Fuel value.	Nutritive ratio.
FOOD PURCHASED.					
In Tennessee:	*Grams.*	*Grams.*	*Grams.*	*Calories.*	*1:*
Animal	63	214	15	2,310	.....
Vegetable	56	10	440	2,125	.....
Total	119	224	455	4,435	.....
In Indiana:					
Animal	62	143	14	1,640	.....
Vegetable	44	14	461	2,200	.....
Total	106	157	475	3,840	.....
In New Jersey:					
Animal	62	134	13	1,555	.....
Vegetable	41	10	418	1,975	.....
Total	103	144	431	3,530	.....
In Connecticut:					
Animal	69	143	22	1,700	.....
Vegetable	44	8	401	1,900	.....
Total	113	151	423	3,600	.....
FOOD WASTED.					
In Tennessee:					
Animal	3	13	.....	135	.....
Vegetable	6	1	43	210	.....
Total	9	14	43	345	.....
In Indiana:					
Animal	13	22	.....	260	.....
Vegetable	3	1	67	295	.....
Total	16	23	67	555	.....

TABLE 24.—*Comparison of nutrients in food purchased, etc.*—Continued.

	Protein.	Fats.	Carbohydrates.	Fuel value.	Nutritive ratio.
FOOD WASTED—continued.					
In New Jersey:	*Grams.*	*Grams.*	*Grams.*	*Calories.*	*1:*
Animal	3	6	.....	70	.....
Vegetable	.....	.....	6	25	.....
Total	3	6	6	95	.....
In Connecticut:					
Animal	4	8	.....	90	.....
Vegetable	1	.....	15	55	.....
Total	5	8	15	145	.....
FOOD EATEN.					
In Tennessee:					
Animal	60	201	15	2,175	.....
Vegetable	50	9	397	1,915	.....
Total	110	210	412	4,090	8.0
In Indiana:					
Animal	49	121	14	1,380	.....
Vegetable	41	13	394	1,905	.....
Total	90	134	408	3,285	7.9
In New Jersey:					
Animal	59	128	13	1,485	.....
Vegetable	41	10	412	1,950	.....
Total	100	138	425	3,435	7.4
In Connecticut:					
Animal	65	135	22	1,610	.....
Vegetable	43	8	386	1,845	.....
Total	108	143	408	3,455	6.8
Average of all:					
Animal	63	139	20	1,630	.....
Vegetable	43	9	391	1,865	.....
Total	106	148	411	3,495	7.0
Standard for a man with moderate muscular work	125	.....	.....	3,500	5.8

The dietary standard for a day's food for a man with moderate muscular work above referred to calls for 125 grams of protein and sufficient fats and carbohydrates in addition to make the whole fuel value 3,500 calories. It will be observed that as measured by this standard the food eaten by the mechanics' families in the places studied was deficient in protein. The dietary of the mechanic's family in Tennessee contained a large excess of the nutrients which serve simply as fuel and tend to make rations wide. It will also be noticed that all of the rations are wide, but with the exception of the Tennessee dietary this is due to a deficiency of protein rather than an excess of fuel value. The food eaten per man per day in the mechanics' families in Connecticut furnished 108 grams of protein and had a fuel value of 3,455 calories, with a nutritive ratio of 1 to 6.8. In the food of the mechanic's family in New Jersey the protein in the food eaten was 100 grams, the fuel value 3,435 calories, and the nutritive ratio 1 to 7.4. In the Indiana mechanic's dietary the protein was only 90 grams, the fuel value was 3,285 calories, and the nutritive ratio 1 to 7.9. In the dietary of the Tennessee mechanic there were 110 grams of protein, with a fuel value of 4,090 calories and a nutritive ratio of 1 to 8. The dietaries of mechanics

agree with those of the college students in the smallness of the proportions of protein and the relative excess of fuel ingredients. They add to the data which indicate that our dietary is out of balance and that the one-sidedness is greater in the South than in the North.

PROTEIN AND FUEL VALUE IN THE DIETARIES OF DIFFERENT MECHANICS' FAMILIES COMPARED.

Table 25 shows the weights and percentages of protein in the animal, vegetable, and total foods purchased in the mechanics' dietaries:

TABLE 25.—*Weights and percentages of protein in animal, vegetable, and total food purchased, wasted, and eaten in dietaries of mechanics' families.*

	Tennessee (1 family).		Indiana (1 family).		New Jersey (1 family).		Connecticut (8 families).	
	Grams.	Per cent.	Grams.	Per cent.	Grams.	Per cent.	Grams.	Per cent.
Animal food:								
Purchased	63	53	62	59	62	60	69	61
Wasted	3	3	13	12	3	3	4	3
Eaten	60	50	49	47	59	57	65	58
Vegetable food:								
Purchased	56	47	44	41	41	40	44	39
Wasted	6	5	3	3	.....	.....	1	1
Eaten	50	42	41	38	41	40	43	38
Total food:								
Purchased	119	100	106	100	103	100	113	100
Wasted	9	8	16	15	3	3	5	4
Eaten	110	92	90	85	100	97	108	96

The table tells its story so plainly that there is little need of comment. As in the case of the college dietaries, there was a much larger proportion of the total protein furnished by the vegetable food in the Tennessee dietary than in that of the others. The waste of protein was not so great in the Connecticut, New Jersey, and Tennessee mechanics' dietaries as was found in those of the college students' clubs. In other investigations much less of table waste has been found in private families than in boarding houses or boarding clubs. The very large waste (15 per cent) in the protein in the food of the Indiana family is unusual. In the Connecticut family dietaries 4 per cent, in New Jersey 3 per cent, in Tennessee 8 per cent, and in Indiana 15 per cent of the protein purchased was left unconsumed in the table and kitchen wastes. The portions thus thrown away came mostly from the meats, which furnish protein in its most digestible, and useful, and expensive forms.

Table 26, which follows, shows the fuel value of the food purchased, wasted, and eaten in the dietaries of mechanics' families.

TABLE 26.—*Calories and percentages of fuel value in food purchased, wasted, and eaten in dietaries of mechanics' families.*

	Tennessee (1 family).		Indiana (1 family).		New Jersey (1 family).		Connecticut (8 families).	
	Calories.	Per cent.	Calories.	Per cent.	Calories.	Per cent.	Calories.	Per cent.
Animal food:								
Purchased	2,310	52	1,640	43	1,555	44	1,700	47
Wasted	135	3	260	7	70	2	90	2
Eaten	2,175	49	1,380	36	1,485	42	1,610	45
Vegetable food:								
Purchased	2,125	48	2,200	57	1,975	56	1,900	53
Wasted	210	5	295	8	25	1	55	2
Eaten	1,915	43	1,905	49	1,950	55	1,845	51
Total food:								
Purchased	4,435	100	3,840	100	3,530	100	3,600	100
Wasted	345	8	555	15	92	3	145	4
Eaten	4,090	92	3,285	85	3,435	97	3,455	96

Owing to the large amount of fat in the meat and the large quantities of lard used in the Tennessee dietary more than half (52 per cent) of the fuel value comes from the animal foods. The fuel value of the food wasted was about equally divided between the animal and the vegetable foods, and as in the case of protein, the waste was largest in the Tennessee and Indiana dietaries. In Connecticut 4 per cent, in New Jersey 3 per cent, in Tennessee 8 per cent, and in Indiana 15 per cent of the fuel value of the total food purchased was thrown away in the table and kitchen wastes.

ARE THESE RESULTS TYPICAL?

To assume that the dietaries of these few families represent the average food consumption of mechanics' families in their respective localities or of the country at large would be very much like taking the weights or the wages of the heads of the families as representing the averages for men of their occupation in the several States or in the United States as a whole. The periods of study were short, from a week to a month each, and the kinds and amounts of food consumed at another time might in any one of the cases be very different. The food of a neighbor's family, if studied at the same time, might have shown very different results. To obtain averages that will be fairly representative it will be necessary to make studies in a large number of places with a large number of families and repeat them at different seasons. In this way we may hope to find the range of variation and the averages of the amounts of food consumed. Meanwhile these results are worthy of more confidence than could otherwise be claimed for so small a number, because they accord very well with those of other investigations in the United States.[1]

THE COMPOSITION OF TENNESSEE BEEF AS COMPARED WITH THAT GROWN ELSEWHERE.

From the few analyses made in the past it appears that Southern grown meats are apt to contain less fat than beef raised on the great ranges of the Northwest and in the Northern States in general. In

[1] See Bulletin 21 of this Office, pp. 141–213.

connection with the World's Fair at Chicago analyses were made of sides of beef of average fatness selected from the Chicago stock yards by experienced men. The results of these analyses were as follows:

Analyses of sides of beef grown in Illinois, Colorado, and Texas.

Where raised.	Number of sides.	Refuse.	Water.	Protein.	Fat.	Ash.	Fuel value of 1 pound.
		Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Calories.*
Illinois[1]	6	17.0	47.5	14.3	20.5	0.7	1,130
Colorado	3	19.2	51.3	14.6	14.2	.7	870
Texas	3	20.0	55.2	15.3	8.8	.7	655

[1] Or neighboring States.

In the following table (27) the chemical composition of three cuts of beef produced in Tennessee and analyzed by Professor Wait is compared with that of similar cuts of beef produced in other localities:

TABLE 27.—*Composition of different cuts of Tennessee beef compared with that grown elsewhere in the United States.*

Portion taken for analysis and its source.	Number of analyses.	As purchased.					
		Refuse.	Water.	Protein.	Fat.	Ash.	Fuel value.
BEEF, CHUCK.							
Tennessee:		*Per cent.*	*Per cent.*	*Per cent.*	*Per ct.*	*Per ct.*	*Calories.*
Minimum	.....	16.1	46.3	13.1	4.5	0.7	470
Maximum	.....	33.1	58.5	16.9	10.9	.9	720
Average	10	23.9	53.5	15.2	6.6	.8	560
American, lean:							
Minimum	.....	18.1	47.6	14.3	4.5	.7	475
Maximum	.....	33.1	58.3	16.8	7.6	.9	635
Average	9	23.7	54.3	15.2	6.0	.8	535
American, medium fat:							
Minimum	.....	10.5	46.3	14.0	7.7	.7	625
Maximum	.....	28.1	60.3	16.8	12.4	.8	815
Average	7	17.0	56.3	15.7	10.2	.8	720
American, all analyses:							
Minimum	.....	10.5	36.5	11.3	3.2	.6	460
Maximum	.....	34.5	60.3	17.4	28.3	.8	1,470
Average	23	19.9	54.1	15.3	9.9	.8	705
BEEF, SIRLOIN.							
Tennessee:							
Minimum	.....	6.2	47,5	14.3	10.0	.8	735
Maximum	.....	22.1	59.9	17.7	20.3	1.9	1,170
Average	10	14.0	54.1	16.3	14.6	1.0	920
American, lean:							
Minimum	.....	6.7	52.1	15.4	10.0	.6	645
Maximum	.....	21.0	66.2	19.8	13.0	1.0	860
Average	11	13.1	58.2	16.7	11.1	.9	780
American, medium fat:							
Minimum	.....	4.1	44.3	8.5	13.7	.4	860
Maximum	.....	22.1	58.1	19.0	22.7	1.9	1,290
Average	28	13.0	52.6	15.9	17.6	.9	1,040
American, all analyses:							
Minimum	.....	3.6	44.3	8.5	7.2	.4	580
Maximum	.....	22.1	66.2	19.8	30.4	1.9	1,580
Average	48	12.6	53.3	15.9	17.3	.9	1,025

TABLE 27.—*Composition of different cuts of Tennessee beef compared with that grown elsewhere in the United States*—Continued.

Portion taken for analysis and its source.	Number of analyses.	As purchased.					
		Refuse.	Water.	Protein.	Fat.	Ash.	Fuel value.
BEEF, ROUND.							
Tennessee:		*Per cent.*	*Per cent.*	*Per cent.*	*Per ct.*	*Per ct.*	*Calories.*
Minimum		4.3	59.1	18.3	3.7	1.0	495
Maximum		17.4	68.7	19.9	10.2	1.2	785
Average	14	8.9	63.8	19.2	7.0	1.1	650
American, lean:							
Minimum		4.8	57.2	16.9	4.6	.3	540
Maximum		17.3	68.8	20.3	9.4	1.2	735
Average	23	8.8	64.2	18.9	7.1	1.0	650
American, medium fat:							
Minimum		3.7	57.6	16.8	10.1	.8	780
Maximum		11.2	65.9	19.9	16.6	1.0	1,025
Average	13	7.7	60.7	18.1	12.6	.9	870
American, all analyses:							
Minimum		3.7	53.2	16.5	1.3	.3	455
Maximum		17.4	72.8	21.4	23.1	1.2	1,280
Average	47	8.5	63.0	18.7	8.8	1.0	720

So far as the analyses which have been made are concerned, beef grown near Knoxville, in Tennessee, is much leaner than that grown in the North and Northwest. That this is so is not against, but rather in favor of the Tennessee-raised beef. There is a tendency in the Northern States, both east and west, to overfatten animals for slaughter.

In general, then, these dietary studies at Knoxville agree with those made elsewhere in implying that the food consumed by people of the United States contains relatively too little of the flesh formers and too much of the fuel ingredients. That is to say, as compared with the generally accepted physiological standards, our dietaries are too wide in their nutritive ratios. The few accurate studies thus far made imply that this one-sidedness is greater in the South than in the North, and accord with the general impression that the common diet in the former region contains an excess of the fatter kinds of meats, as pork, and of the starchy and sugary vegetable foods, such as corn meal and molasses. What is needed is to use foods better adapted to the needs of the body, in other words, foods which contain more protein. Such are lean meats, as beef and veal and chicken; fish, like salt cod and mackerel, and fresh fish where they are obtainable; milk, which is of itself an economical and well-balanced food; skim milk, which has all the protein and half the fuel value of whole milk and is in most localities the most economical source of animal protein; oat meal; beans, peas, and other legumes, especially cowpeas.

Fresh beef, veal, and chicken are among the more expensive sources of protein, but are admirably adapted to the needs of the body for nutriment. The nutrients in milk are equally valuable physiologically as

those of meats, and far less expensive. The protein of vegetable foods is less completely digested, but there is no reason to assume that the digestible portion is less useful for nutriment than that of meat, fish, and milk.[1]

Physiological chemistry coincides with the general experience of mankind in assigning to the leguminous seeds, such as beans and peas, a very high nutritive value. They can be made as palatable as other vegetable foods, and deserve much more consideration than they have received in the South. This is especially true of cowpeas, the value of which is fortunately coming to be appreciated in the South. This value is threefold. The cowpea gathers nitrogen from the air, stores it in both the roots and tops of the plant, and thus makes it a remarkably useful renovator of the soil. It is an excellent food for stock; its large proportion of protein makes it especially useful for feeding with poor hay, straw, cornstalks, and other common hay substitutes, and when this is fed it makes a rich manure. And finally the seeds, which are produced in great abundance and variety in different parts of the South, can be made into most wholesome and palatable dishes, and thus used will supply a serious lack in the diet of that region.

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[1] For discussion of the nutriments in food materials as compared with their cost, see Farmers' Bulletin No. 23, "Foods: Nutritive value and cost."