

THE ENERGY AND THE PROTEIN INTAKE
OF TWO COLLEGE WOMEN

by

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INTRODUCTION

Nutrition workers wish to know what kinds of food college students eat, what determines their choice, and how their health reacts to the foods they eat. Exact information is also desired concerning the amount of food eaten, believing that it may aid in the formation of nutrition standards for this group.

To answer the question which has arisen as to how much food a normal college woman eats, it is necessary to study her food habits in considerable detail. There has been some indication that college women are eating less food than they were a few years ago and perhaps less than may be desirable for maintenance of good health. It has been suggested that this low food intake may be the result of an attempt to attain the slender figure so much in vogue at the moment which, unfortunately, may be secured at the expense of good nutrition. It would seem that more information is needed to determine the optimal food intake for women of this age.

During the past 50 years the diets of various groups of American people have been analyzed for varying periods of time. These early dietary investigations were mainly group studies of the inventory type. As a rule, in these researches it was assumed that all edible food served was eaten, although in some of the later studies, allowance was

made for edible waste. Such work, at best, indicates only the average per capita food consumption.

Another kind of dietary study involves the food actually consumed by the individual. This type supplies more information but the work is time-consuming so the number of subjects used for any one investigation is necessarily limited.

The food value of the diets in either case has, as a rule, been calculated from standard tables of food composition. The values in these tables represent the average of analyses of varying numbers of food samples rather than those of the foods actually eaten. It has been suggested that it is desirable to analyze samples of the food used whenever possible because of differences in composition due to the effects of climate, soil, grade, and other factors.

Many of the more exact dietary studies previously reported have been of short duration. It is now believed that long periods of observation are preferable if the food habits are to be depicted accurately. This study was planned to determine the food consumption over a period of eight consecutive weeks of two college women and to analyze aliquots of their freely chosen diets for energy and protein.

REVIEW OF LITERATURE

According to Richards (17), one of the first studies in America of the food intake of college women was made by Richards and Talbot in

1894. These workers found the students at this institution were consuming an average of 3,277 Calories per person per day. In the same year, Atwater and Woods (1) reported an average per capita daily intake for a College Ladies' Eating Club of 3,270 Calories and 105 grams of protein. Two years later, Ladd (14) made an inventory study of 11 women in a college boarding house at North Dakota Agricultural College. These subjects consumed 2,660 total Calories and 64 grams of protein per person per day.

In 1900, Bevier and Sprague (4) studied 115 women at Lake Erie College in Ohio over a 10-day period. These students were fed at a cost of \$0.25 per capita per day. The results were similar to those reported by Ladd (14), each person consuming an average of 2,665 Calories and 68 grams of protein daily.

A desire to standardize food conditions in college halls for women led Borthwick (7) in 1917 to make an eight-day inventory dietary study of a group living in a woman's residence hall at Montana State College. This group consumed an average of 2,549 Calories per person daily.

Even as late as 1918 Macleod and Griggs (16), from the findings of a dietary study of Vassar students, reported the average daily intake to be 2,698 Calories per capita. The next year Bevier (5) made a careful study of 12 groups of women students at the University of Illinois. Her survey covered a period of seven days. Calculations of nine of the 12

groups studied showed an average daily consumption of 2,419 Calories and 69.5 grams of protein per person per day.

Hawley (13) reported dietary studies made by the Bureau of Home Economics on members of 192 college organizations and summarized 11 dietary investigations previously made by other workers on similar groups. This study indicated that college students consumed an average of 15 per cent more energy than is commonly believed to be necessary.

In contradiction to the above statements of high Calorie intake which suggest abundant nutrition, Chaney and Ahlborn (8) say concerning the distribution of weights of 245 representative Kansas State College women that "less than one-third of the girls were within the optimal range, more than one-half were below optimal weight, and approximately one-sixth of them were more than 10 per cent underweight."

Blunt and Bauer (6), 28 years after the study by Richards and Talbot, investigating the food habits of 28 young underweight but healthy women at the University of Chicago note that "10 girls ate less than 1,800 Calories per person per day, 16 less than 2,000, and only two over 2,200 Calories."

More recently a cooperative research was undertaken by the Nutrition Laboratory of the Carnegie Institution of Washington and the New Hampshire Agricultural Experiment Station. The object was to determine the energy and the protein content of foods regularly eaten by a college

community. Benedict and Farr (2) in cooperation with this research made a seven-day study of the food consumption in a practice house at the University of New Hampshire. They reported an average daily intake per capita of 2,446 Calories and 61 grams protein for these women students.

In 1929, as the result of a one-week inventory dietary study of nine sororities, two home management houses, and one dormitory, Grace (11) reported that Oregon State College women had a daily per capita intake ranging from 2,156 to 2,765 Calories in the different groups. The next year Searle and Arnold (21), making an individual study of eight women students at Iowa State College found that their subjects were consuming an average of 2,340 Calories daily.

Coons (10) in a more recent study at the Oklahoma College of Agriculture and Mechanic Arts, also using the individual method, found that women students, serving as subjects at that institution and living on self-chosen diets, consumed an average of only 1,990 Calories and 56 grams of protein per capita per day. She says, "There is evidence that the habitual food consumption of present day college women is lower than it was a generation ago, and that it is lower in Oklahoma than in some other sections of the United States."

Goddard (12), in 1931, observed a high caloric intake in her study of the nutritive value of foods consumed in a woman's dormitory at the University of California. Her investigation covered two eight-day periods which were not consecutive. The 105 women studied consumed an

average of 3,699 Calories per person per day during the first period and only 2,501 Calories throughout the second period. Their estimated requirement was 2,300 Calories daily per capita.

At Kansas State College, Ryder (19) and Littleford (15) in 1932, and Schermerhorn (20) in 1936, confirmed the low caloric intake of present-day college women suggested by Coons (10) in a study of the food consumed by a group living in a residence hall on that campus. In 1936 an average of 2,088 Calories per person per day or 34.5 Calories per kilogram was consumed. While this was a little higher than the figure for 1932 of 1,891 total Calories, and considerably higher than the 29.7 Calories per kilogram per capita, it was lower than the commonly recommended standard for energy as set by Sherman (22), amounting to 2,400 Calories for a 56 kilogram woman or 42.9 Calories per kilogram.

Another study made on Kansas State College women by Conard (9) in 1934, gave similar but slightly higher results when compared on the basis of Calories per kilogram of weight. She found that the subjects, who were living in a sorority group, were using a total of 2,055 Calories per person daily which amounted to 36.9 Calories per kilogram.

PROCEDURE

Two senior college women majoring in Home Economics served as subjects. Their training had made them interested in such a study and enabled them to cooperate to the fullest extent. Physical examinations

by the college physician and basal metabolism tests indicated that the young women were normal physically. Subject L was of a linear type of build; Subject A was considered average in this respect.

The young women were regarded as moderately active. Each carried a full school schedule, did the necessary duties involved in maintaining an apartment and preparing meals, worked in an office an average of 11 hours a week, and walked seven blocks to the campus twice daily. Each subject weighed herself at the same time and, as nearly as possible, under the same conditions each morning upon rising.

Meals were served regularly except on Sunday when, as a rule, breakfast was omitted. One meal more substantial than usual was eaten at noon on this day and additional food, as ice cream or a sandwich, was taken in the evening.

Water sufficient for drinking purposes for each subject for one day was weighed. The weight of that remaining for each individual at the end of the day was subtracted from the original weight of the water to determine the amount obtained in this way. As the diet was unrestricted it was necessary to permit occasional drinking from fountains. Water thus supplied was estimated at 10 grams per swallow and was added to the weighed amount to determine the total consumption for the day.

Table I. Summary of intake of liquid

Subject	Total for 8-week period				Average per day*	Glasses per day
	Water	Coffee, tea, :coca cola	All liquid			
	gm.	gm.	gm.	gm.		
L	46007.2	22034.5	68041.7	1215.0	6.5	
A	38833.5	13839.2	52672.7	940.6	5.0	

* 185 grams = one glass

A Torsion balance or a Harvard trip balance of 1,000 grams capacity was used for weighing. These two scales were checked against each other for accuracy. The weight of each serving of food was recorded. Additional servings were given as requested and this weight added to the original total. Any food which was served but not eaten was weighed and the amount subtracted from the original weight. A duplicate of all food eaten out was secured and weighed. These servings were similar in size as most of the meals were obtained at restaurants where the food portions were more or less standardized. It was possible in the other instances for the subjects to serve the duplicates as well as their own plates. So the quantities, while not identical, were similar.

Individual serving dishes and glasses were provided for each subject. These were marked with her initial by means of a wax pencil on adhesive tape. In order to save time in weighing, counterpoises were made for each of these serving utensils. They were checked frequently to insure no changes in weight with usage. For still greater convenience,

if the nature of the food permitted, the weighing was done on tared pieces of wax paper.

The samples represented one-tenth of the weight of each serving of food. They were made into weekly composites, one for each subject. With the exception of butter and oleomargarine, the food aliquots were collected in beakers for each 24-hour day, preserved with a drop of formaldehyde, and emptied daily into an evaporating dish which held the week's collection for each subject. These were dried in a gas-heated oven at a temperature of approximately 60°C. Drying was a continuous process after the first 24 hours, fresh material being added daily.

The drying was continued until the weight varied less than one gram in two successive weighings made 24 hours apart. The dried food was then ground in a food chopper after which it was put through a 20-mesh sieve. Any particles not going through the sieve readily were reground in a mortar with a pestle until sufficiently fine to pass through the mesh. The powdered samples were then stored in glass-stoppered bottles.

When ready for analysis, a portion of the well-mixed sample was transferred to a weighing bottle and heated for three hours in a Freas oven at a temperature of 80°C. It was then stored in a desiccator until used.

The butter fat necessitated a somewhat different procedure. As it complicates the drying of foods, all samples of butter and oleomargarine

served as such, were put into a separate beaker, one for each person each week. These were preserved in a refrigerator until analyzed.

The oxy-calorimeter, originated by Benedict and Fox (3), was used to determine the caloric value of the food eaten. This device is of somewhat simpler construction than the bomb calorimeter which was previously necessary to determine the energy value of food stuffs. The oxy-calorimeter is now extensively used in industrial and nutrition laboratories and has a limit of error of not more than three per cent which is regarded as sufficiently accurate for these determinations.

The principle of this machine is based upon the fact that dry organic material burns in pure oxygen if the carbon dioxide, the chief product of combustion, is removed rapidly. It is desired to measure the amount of oxygen used in the combustion process. As the actual amount of heat liberated in combustion of different substances has already been determined with the bomb calorimeter, tables have been prepared from which it is possible to calculate the caloric value of the substance burned in the oxy-calorimeter from the liters of oxygen required for its combustion. However, it is necessary to know whether the substance burned is made up of fat, carbohydrate, protein, or a mixture of these food stuffs.

The combustion chamber consists of a pyrex glass lamp chimney, containing an atmosphere rich in oxygen supplied from a spirometer. The current of air enters the chamber at the top, leaves at the bottom and

passes through soda lime where the carbon dioxide formed in combustion is completely absorbed. It is also cooled by immersing a U-bend in the tube in ice water. The air is then returned to the top of the chamber by means of a small rotary blower, thus making a complete circuit.

The oxygen supply is held in a counterpoised spirometer which is connected with a rubber tube leading from the blower to the top of the combustion chamber. In combustion, oxygen is used and the supply inside the circulating system decreases. A discharge of oxygen from the spirometer into the main current makes up the loss and the result is a fall in the level of the spirometer bell. This fall, read on a millimeter scale attached to the spirometer, shows the volume of oxygen consumed.

In the burning of all samples care was taken to see that no leaks occurred in the circulating system whereby oxygen might escape. The thermometers were tested, and the soda lime was changed as necessary to insure efficiency.

To determine the caloric content of the diet, one gram portions of the oven-dry material were weighed accurately into nickel crucibles on an analytical balance. A small amount of powdered pumice stone was sprinkled over the surface to insure combustion when ignited. The average of three determinations which agreed within two per cent was used. The fat was burned in one-half gram portions after mixing into a thick paste with pumice. The paste was then shaped into a peak and the glass

rod used in mixing left in the sample during combustion. The process is described in detail by Benedict and Fox (3).

At the end of the combustion process there were usually some flecks of carbon remaining in the crucible as complete oxidation is difficult to obtain. Correction was made for this (Table II) by weighing the crucible at the end of the combustion period and again after subjecting it to the flame of a Meeker burner. A loss in weight would occur due to the burning of the residual carbon. As each milligram of carbon corresponds to 1.9 cc. of oxygen, an additive correction was made as necessary.

Free nitrogen is liberated when a substance containing nitrogen is burned. When such a combustion takes place in the oxy-calorimeter where there is a confined volume of oxygen, the contraction of the bell as measured, will always be less than that represented by the true volume of oxygen used in the process. Consequently, the nitrogen content of the food was determined by the Kjeldahl-Gunning procedure and additions in the proportions of 800.5 cc. oxygen per gram nitrogen were made for the same (3).

The sample in the oxy-calorimeter was ignited by means of an iron wire fuse set off by electrical contact. To compensate for the oxygen used in the burning of the wire, five centimeters were subtracted from the total oxygen consumed.

The method of calculation was based upon the liters of oxygen used under the immediate barometric conditions, after corrections were made for carbon, nitrogen, and wire fuse. The total oxygen consumed was multiplied by a suitable factor which varied according to whether the

mixed diet or the fat was being burned.

Table II. Illustration of calculations for the burning of a mixed food sample in the oxy-calorimeter

Data:

Soda lime temperature - - - - -	27 C.
Spirometer bell temperature - - - - -	27 C.
Barometric pressure - - - - -	736 mm.
Correction for temperature and pressure - - - - -	0.855
Volume of oxygen before combustion - - - - -	286 mm.
Volume of oxygen after combustion - - - - -	236 mm.
Volume of oxygen used - - - - -	50 mm.
Weight of crucible after combustion - - - - -	7.3562 gm.
Weight of crucible after burning to constant weight over flame - - - - -	7.3172 gm.
Weight of residual carbon - - - - -	0.0390 gm.
Weight of nitrogen - - - - -	0.02073 gm.
Weight of sample burned - - - - -	1.0 gm.

Calculation:*

$50 \times .855 = 42.75$ —mm. oxygen used corrected for temperature and pressure.

$(42.75 \times \frac{20.73}{2}) - 5 = 881$ —cc. oxygen used.

$0.0390 \times 1.9 = 74$ —cc. oxygen equivalent to residual carbon.

$0.02073 \times 800.5 = 17$ —cc. oxygen equivalent to nitrogen.

$881 + 74 + 17 = 973$ —cc. oxygen used corrected for nitrogen and carbon.

973 cc. oxygen 0.973 liters.

$0.973 \times 4.825 = 4.7$ —Calories per gram.

* Excepting that a factor of 4.7 instead of 4.825 is used, the calculations for fat are made in the same manner.

1. Volume of spirometer bell in cc. per mm. of length - - - - -	20.73
2. Cc. oxygen consumed by iron wire fuse - - - - -	5.00
3. Cc. oxygen equivalent to one gm. carbon - - - - -	1.90
4. Cc. oxygen equivalent to one gm. nitrogen - - - - -	800.50
5. Calories per gm. mixed food as found with bomb calorimeter - - - - -	4.825

RESULTS AND DISCUSSION

A standard of 2,400 total Calories or 42.9 Calories per kilogram per person has been set as the energy requirement for the average woman, assuming for her a weight of 56 kilograms. She is regarded as 0.8 of the adult male unit for whom a standard of 3,000 Calories per 70 kilograms has been set (22).

On the basis given above the energy intake of each of the two subjects in this study was low (Tables III, IV, V, VI, VII). Subject L consumed an average of 1,963 total Calories or 39.0 per kilogram per day for the eight-week period and Subject A, a daily total of 1,716 or 35.5 Calories per kilogram. This was 90.9 and 88.9 per cent respectively of what has been customarily accepted as necessary for adequate energy for persons with the types of build and activity of these subjects.

Table III. Caloric value of diets

Sub-ject	Week	Dry food other		Fat		Calories			
		Weight	Calories	Weight	Calories	Food other	From	To	Av.
		than visible fat	(1)	(4)	(3)	than vis-ible fat	fat	tal	per day
		gm.	per gm.	gm.	per gm.				
				(2)					
L	1	2417	4.7	152	9.6	11360	1459	12819	1831
	2	2963	5.1			15111		15111	2159
	3	3273	4.8	64	8.9	15710	570	15767	2252
	4	2912	5.0	36	9.6	14560	346	14906	2129
	5	2442	4.7	24	9.1	11477	218	11695	1670
	6	2533	5.1	53	9.3	12918	493	13411	1916
	7	2563	5.2	34	8.8	13328	299	13627	1947
	8	2684	4.7			12615		12615	1802
Av.		2724	4.9	52	9.2	13385	483	13744	1963
				(2)					
A	1	2743	4.7	137	8.4	12892	1151	14043	2006
	2	2568	5.0			12840		12840	1834
	3	2877	4.9	38	8.6	14097	327	14424	2061
	4	2282	4.8	33	8.8	10954	290	11244	1606
	5	2227	4.9	24	8.9	10690	214	10904	1558
	6	2282	4.7	39	8.9	10725	347	11072	1582
	7	2320	4.6	28	8.7	10672	244	10916	1559
	8	2267	4.7			10655		10655	1522
Av.		2446	4.8	43	8.7	11691	367	12013	1716
Average for both subjects									1840

(1) Liters O₂ consumed per gm. of dry sample x 4.825.

(2) Butter samples combined for weeks 1 and 2.

(3) Liters O₂ consumed per gm. x 4.7.

(4) With the exception of week 8 when the fat was added to food sample.

Table IV. Data on combustion of food samples other than butter and oleomargarine

Subject L										
Week:	Sam- (1)	(2)		(3)		Oxygen consumed				
		Weight	O ₂ equiv-	Per gm.	O ₂ equiv-	As meas- ured	Corrected for car- bon	Corrected for ni- trogen		
		gm.	cc.	gm.	cc.	cc.	cc.	cc.		
1	1	0.0426	81			872	953			
	2	0.0391	74			881	955			
	3	0.0315	60			906	966			
	Av.	0.0374		0.02073	17		958			975
2	1	0.0394	75			961	1036			
	2	0.0268	51			985	1036			
	3	0.0110	21			1003	1024			
	Av.	0.0257		0.02404	19		1032			1051
3	1	0.0285	54			935	989			
	2	0.0578	110			868	978			
	3	0.0304	58			940	998			
	Av.	0.0389		0.02186	17		988			1005
4	1	0.0221	42			991	1033			
	2	0.0154	29			991	1020			
	3	0.0385	73			955	1028			
	Av.	0.0253		0.02373	19		1027			1046
5	1	0.0607	115			846	961			
	2	0.0202	38			909	947			
	3	0.0296	56			903	959			
	Av.	0.0368		0.02825	23		956			979
6	1	0.0349	66			978	1044			
	2	0.0476	90			958	1048			
	3	0.0333	63			970	1033			
	Av.	0.0386		0.02743	22		1042			1064

(1) Weight of sample = 1 gm. dried food composite.

(2) Carbon remaining in crucible after combustion.

(3) Nitrogen determined by Kjeldahl procedure.

Table IV. (Continued)

Subject L									
Week:	Sam- (1)	(2)		(3)		Oxygen consumed			
ple	Weight	O ₂ equiv-	Per gm.	O ₂ equiv-	As meas-	Corrected	Corrected	Corrected	Corrected
:	:	alent	food	alent	ured	for car-	for ni-	bon	trogen
:	:	gm.	cc.	gm.	cc.	cc.	cc.	cc.	cc.
7	1	0.0715	136			918	1054		
	2	0.0385	73			968	1041		
	3	0.0340	65			972	1037		
	Av.	0.0460		0.02964	24		1044		1068
8	1	0.0108	21			946	967		
	2	0.0264	50			898	948		
	3	0.0250	48			918	966		
	Av.	0.0207		0.02586	21		960		981

(1) Weight of sample = 1 gm. dried food composite.

(2) Carbon remaining in crucible after combustion.

(3) Nitrogen determined by Kjeldahl procedure.

Table V. Data on combustion of butter and oleomargarine

Subject L						
Week:	Sample:	Carbon		Oxygen consumed		Calories
:	(1)	Weight	O ₂ equiv-	As meas-	Corrected	(2)
:	:	alent	ured	ured	for carbon	:
:	:	gm.	cc.	cc.	cc.	per gm.
1-2	1	0.0526	100	908	1008	
(3)	2	0.0610	116	851	967	
	3	0.0360	68	1026	1094	
	Av.	0.04986			2046	9.6

(1) Weight of samples = 0.5 gm. excepting no. 3 of sample 4, which weighed 0.303 gm.

(2) Calories obtained by multiplying liters O₂ by 4.7.

(3) Samples combined in weeks 1 and 2.

Table V. (Continued)

Subject L						
Week:	Sample:	Carbon		Oxygen consumed		Calories
:	(1)	Weight	O ₂ equiv- alent	As meas- ured	Corrected for carbon	(2)
:	:	gm.	cc.	cc.	cc.	per gm.
3	1	0.0805	115	805	920	
	2	0.0381	72	894	966	
	3	0.0244	46	899	945	
	Av.	0.0410			1887	8.9
4	1	0.0510	97	906	1003	
	2	0.0517	98	954	1052	
	3	0.0216	41	567	1003 (4)	
	Av.	0.0414			2039	9.6
5	1	0.0350	67	908	975	
	2	0.0204	39	930	969	
	3	0.0145	28	925	953	
	Av.	0.0233			1931	9.1
6	1	0.0243	46	938	984	
	2	0.0252	48	955	1003	
	Av.	0.02475			1987	9.3
7	1	0.0840	160	754	914	
	2	0.0516	98	868	966	
	Av.	0.0678			1880	8.8

- (1) Weight of samples = 0.5 gm. excepting no. 3 of sample 4, which weighed 0.303 gm.
- (2) Calories obtained by multiplying liters O₂ by 4.7.
- (3) Samples combined in weeks 1 and 2.
- (4) Calculated for $\frac{1}{2}$ gm. Oxygen for sample burned = 608 cc. instead of 1003.

Table VI. Data on combustion of food samples other than butter and oleomargarine

Subject A									
Week:	Sam- ple (1)	(2) Carbon Weight:O ₂ equiv- :alent		(3) Nitrogen Per gm.:O ₂ equiv- :food :alent		Oxygen consumed As meas-:Corrected:Corrected :ured :for car- :for ni- :bon :trogen			
:	:	gm. :	cc. :	gm. :	cc. :	cc. :	cc. :	cc. :	cc. :
1	1	0.0335	64	:	:	897	961	:	:
	2	0.0130	25	:	:	931	956	:	:
	3	0.0130	25	:	:	929	954	:	:
	Av.	0.0198	:	0.02205	18	:	957	975	:
2	1	0.0340	65	:	:	965	1030	:	:
	2	0.0077	15	:	:	1002	1017	:	:
	3	0.0438	83	:	:	948	1031	:	:
	Av.	0.0285	:	0.02141	17	:	1026	1043	:
3	1	0.0700	133	:	:	858	991	:	:
	2	0.0151	29	:	:	963	992	:	:
	3	0.0154	29	:	:	948	977	:	:
	Av.	0.0355	:	0.02331	19	:	987	1006	:
4	1	0.0503	96	:	:	891	987	:	:
	2	0.0605	115	:	:	867	982	:	:
	3	0.0246	47	:	:	929	976	:	:
	Av.	0.0451	:	0.02698	22	:	982	1004	:
5	1	0.0155	29	:	:	946	975	:	:
	2	0.0431	82	:	:	877	959	:	:
	3	0.0509	97	:	:	970	1067	:	:
	Av.	0.0365	:	0.02596	21	:	1000	1021	:
6	1	0.0077	15	:	:	926	941	:	:
	2	0.0432	82	:	:	871	953	:	:
	3	0.1019	194	:	:	739	933	:	:
	Av.	0.0509	:	0.02733	22	:	942	964	:

(1) Weight of sample - 1 gm. dried food composite.

(2) Carbon remaining in crucible after sample was burned.

(3) Nitrogen determined by Kjeldahl-Gunning procedure.

Table VI (continued)

Subject A								
Week:	Sample:	Carbon		Nitrogen		Oxygen consumed		
:	(1)	Weight:	O ₂ equiv- alent	Per gm. : food	O ₂ equiv- : alent	As meas- : ured	Corrected : for car- : bon	Corrected : for ni- : trogen
:	:	gm.	cc.	gm.	cc.	cc.	cc.	cc.
7	1	0.0154	29			911	940	
	2	0.0278	53			896	949	
	3	0.0280	53			879	932	
	Av.	0.0234		0.02825	23		940	963
8	1	0.0098	19			941	960	
	2	0.0067	13			949	962	
	3	0.0162	31			926	957	
	Av.	0.0109		0.02493	20		960	980

- (1) Weight of sample = 1 gm. dried food composite.
 (2) Carbon remaining in crucible after sample was burned.
 (3) Nitrogen determined by Kjeldahl-Gunning procedure.

Table VII. Data on combustion of butter and oleomargarine

Subject A						
Week:	Sample:	Carbon		Oxygen consumed		Calories
:	(1)	Weight	O ₂ equiv- : alent	As meas- : ured	Corrected : for carbon	(2)
:	:	gm.	cc.	cc.	cc.	per gm.
1-2	1	0.0175	33	857	890	
(3)	2	0.0181	34	888	922	
	3	0.0363	69	815	884	
	Av.	0.0240			1797	8.4

- (1) Weight of samples = 0.5 gm.
 (2) Calories obtained by multiplying liters O₂ by 4.7
 (3) Samples combined in weeks 1 and 2.

Table VII (continued)

Subject A

Week:	Sample:	Carbon		Oxygen consumed		Calories (2)
		Weight	O ₂ equiv- alent	As meas- ured	Corrected for carbon	
	(1)	gm.	cc.	cc.	cc.	per gm.
3	1	0.0560	106	849	955	
	2	0.0074	14	907	921	
	3	0.0025	5	876	881	
	Av.	0.0220			1838	8.6
4	1	0.0380	72	849	921	
	2	0.0320	61	892	953	
	Av.	0.0333			1874	8.8
5	1	0.0281	53	872	925	
	2	0.0199	38	925	963	
	Av.	0.0240			1888	8.9
6	1	0.0225	43	906	949	
	2	0.0549	104	849	953	
	3	0.0365	69	884	953	
	Av.	0.03796			1903	8.9
7	1	0.0330	63	849	912	
	2	0.0298	57	879	936	
	3	0.0298	57	879	936	
	Av.	0.03086			1856	8.7

(1) Weight of samples = 0.5 gm.

(2) Calories obtained by multiplying liters O₂ by 4.7.

(3) Samples combined in weeks 1 and 2.

The average daily intake of 1,840 Calories for the two women used in this investigation is low. With the exception of the subjects of Blunt and Bauer (6) using an average of 1,830 Calories per person per day, it is lower than any recorded in the studies summarized in Table VIII. It may be seen that the groups of Richards and Talbot (17) and of Atwater and Woods (1) used nearly twice as many Calories per capita and the consumption of the other groups cited was higher also, ranging from 51 to 1,430 Calories more per person per day.

However, when data permitted comparison on the basis of Calories per kilogram, the energy intake of the women in this study was high, averaging 37.3 Calories (Table VIII). In contrast to this, Schermerhorn's (20) subjects averaged 34.5; Conard's (9), 36.9; Coon's (10), 35.0; and Ryder's (19), 31.0 Calories per kilogram. While Blunt and Bauer's subjects (6), using the same number of Calories per kilogram as the Kansas women, the former should have had 43.2 Calories to be considered adequately nourished according to these workers.

Table VIII. Summary of studies

Study	Location	Calories :Av. per: :capita	Protein :Av. per :kilogram
Richards and Talbot	Univ. of Chicago	3277	gm.
Atwater and Woods		3270	105.0

Table VIII (continued)

Study	Location	Calories		Protein
		Av. per capita	Av. per kilogram	
Borthwick	Montana State College	2549		
Macleod and Griggs	Vassar College	2698		
Bevier	Univ. of Ill.	2419		69.5
Bevier and Sprague	Lake Erie College	2665		68.0
Grace	Oregon State College	2156-2765		
Searle and Arnold	Iowa State College	2340		56.0
Blunt and Bauer	Univ. of Chicago	1830	37.3	
Coons	Okla. A & M College	1990		
Schermerhorn	Kansas State College	2088	34.5	
Ryder and Littleford	Kansas State College	1891	29.7	
Conard	Kansas State College	2055	36.9	
Benedict and Farr	Univ. of New Hampshire	2446		56.5
Ladd	North Dakota Agr. College	2660		64.0
This study	Kansas State College	1840	37.3	56.5

Personal differences in food consumption were evident. From Table III it may be noted that with the exception of weeks 1 and 2, Subject L, who was of linear build, consumed more Calories per day than Subject A, of medium build. This was true both for total Calories and for Calories per kilogram. Although Subject L ate more food she was 10 per cent underweight, while Subject A was only 7.6 per cent below normal weight. Such variations in total food intake were to be expected because of differences in size and body surface but the fluctuation in weight was too slight to be regarded as important. It does not appear to support the idea that persons of linear type utilize their food less well than those of average build tend to do, hence have a higher food requirement.

The Calories consumed varied with the appetite. The total per day for Subject L (Table III) fluctuated considerably, ranging from 1670 to 2252. Subject A with a range of 1522 to 2061 Calories, had a more constant record during the last half of the study, but, during the first three weekly periods she showed much higher food consumption than was evident in the remaining five weeks. With the exception of the first period, her intake was lower than that of Subject L. The maximum consumption of both women was reached in the third week with Subject L consuming 2252 Calories which is 191 more than Subject A used. The maximum variation between the consumption of the two individuals was during the fourth week when Subject L consumed each day an average of 2199 Calories,

523 more than the 1,676 used by Subject A. The following week gave the minimum variation with Subject A consuming 1,558 Calories and Subject L 1,670, only 112 more than Subject A.

If the "fatness" of an individual is an index to the amount of food eaten, as suggested by Sherman (22), then it would seem that the diets were barely sufficient in energy. In comparison with the average individual of like age, sex, and build according to Wood's table of weight and height for women of different ages as reported by Rose (18), Subject L weighing 50.3 kilograms was 12 pounds or 10 per cent underweight and Subject A of 48.3 kilograms was 8.7 pounds or 7.6 per cent below the average weight for her height and age (Table IX). Subject L showed a very slight gain in weight during the experiment while Subject A showed a slight loss (Table IX). Neither was probably sufficient to be significant as small daily variations in weight are to be expected and these were well within the limits for such differences. The subjects were believed to have completed their growth as they were 24 and 25 years old respectively.

If we accept Sherman's (22) estimate of the protein requirement for an adult as one gram per kilogram of body weight per day, both subjects had sufficient amounts as the intake for Subject L averaged 1.2, and for Subject A, 1.1 grams per kilogram (Table X). The quality of the protein was also fairly good as animal sources appeared frequently in the diets. Meat was eaten on an average 1.1 times per day by Subject L and 0.9 times

Table IX. Personal data concerning subjects

Sub-ject:	Class	Age	Height	Weight			Activ-ity	(1) Sleep	(2) Basal Metabolism	Food cost per day
				Range	Average	Predicted				
		yr.	cm.	kg.	kg.	kg.		hr.	per cent	av.
L	Senior	24	159	51.05 -- 51.30	50.30	55.90	moderate	7	--7.5	\$0.33
A	Senior	25	147	48.13 -- 47.00	48.30	52.30	moderate	7	--9.9	\$0.27

- (1) Average hours per day.
- (2) DuBois standard.
- (3) Low figure used.

by Subject A. It is considered desirable to include at least one egg every other day in the diet and preferably one every day. These women each averaged only 0.2 of an egg each day which would mean about one and one-half per week, considerably fewer than has been recommended.

Table X. Protein value of diets

Sub-ject:	Week:	(1)	(2)			(4)		
		Dry food	Nitrogen	O ₂ equiv-	Per week	Per week	Per day	Per kilogram
		Per gm. food	Per gm. food	Per cc. alent	Per gm. week	Per gm. week	Per gm. day	Per gm. kilogram
		gm.	gm.	cc.	gm.	gm.	gm.	gm.
					(3)			
L	1	2717	0.02073	17	43	269	38	
	2	2963	0.02404	19	71	444	63	
	3	3273	0.02186	17	72	450	64	
	4	2912	0.02373	19	69	431	62	
	5	2442	0.02825	23	59	369	53	
	6	2533	0.02743	22	69	431	62	
	7	2563	0.02964	24	76	475	68	
	8	2684	0.02586	21	69	431	62	
	:Av.	2761			68	422	59	1.2
A	1	2743	0.02205	18	60	375	54	
	2	2568	0.02141	17	55	344	49	
	3	2877	0.02331	19	67	419	60	
	4	2282	0.02698	22	62	388	55	
	5	2227	0.02596	21	57	356	51	
	6	2282	0.02733	22	62	388	55	
	7	2320	0.02825	23	66	413	59	
	8	2267	0.02493	20	57	356	51	
	:Av.	2448			61	382	54	1.1

(1) Other than visible fat with the exception of week 8.

(2) Nitrogen cc. = 800.5 x nitrogen per gram.

(3) Grams nitrogen = nitrogen per gram x grams food.

(4) Protein = grams nitrogen x 6.25.

The amount of milk consumed was much below the standard of one pint per person per day. As a beverage, it was used 31 times during the eight-week period by Subject L, and 39 times by Subject A. Assuming the amount each time to be equivalent to one cup, Subject L consumed about 0.27 pint daily. Subject A had a higher average of about 0.35 pint daily. Some milk was used in ice cream which was served an average of 0.3 times daily for Subject L and 0.4 times for Subject A. A small amount of milk was included in such foods as gravy, but this was not enough to bring the quota even to half the desired amount. Cottage cheese and cream cheese were served occasionally. Some peanut butter was used and dried legumes appeared in the diets frequently.

According to accepted standards it is desirable that the diet contain two vegetables each day in addition to potato, one of them green or leafy. This standard was more than met, Subject L having an average of 1.3 servings of green vegetables daily and Subject A, 1.2.

The use of fruit did not meet the standard of two servings daily, one of them citrus fruit or tomato. Subject L had a total of 1.8 servings of fruit daily and Subject A's consumption was slightly lower averaging 1.6 servings.

Few whole grain products were used. These consisted chiefly of bread, though some breakfast cereals were used. Each subject consumed but a little more than half the standard of one serving of such foods each day.

The menus (Tables XI to XVIII) show considerable variation and care in planning. An effort, was undoubtedly made to apply some of their knowledge of nutrition to the food combinations used. The meals were colorful and generally attractive.

A summary (Table XIX) of the food habits indicates considerable eating between meals, 0.8 times a day for Subject L and 0.7 times for Subject A. This occurred as a rule before bed-time and included such foods as celery, olives, and coffee. Frequently more than one food was eaten at a time.

It would seem that too much coffee, coca cola, and tea were consumed as these beverages averaged 2.2 times daily in the diet of Subject L and 1.5 times in that of Subject A. They constituted 32 per cent and 26 per cent respectively of the liquid intake (Table I) of each subject.

The food costs of the diets paralleled the intake. Subject L, having the highest food consumption also had the highest daily average cost amounting to \$0.33. The average daily cost of food for Subject A was \$0.27.

It is assumed that the food eaten by these subjects during the experimental period, being freely chosen, was typical of that which they consumed throughout the year. Although judgment cannot be passed upon the adequacy of the diet as a whole without further analyses, the study does indicate that the protein intake was probably sufficient while the energy content was considerably lower than the commonly accepted stand-

ard for this nutrient. It suggests a need for further study with the idea of a possible revision of present day energy standards for this age group.

Table XI. Menus served during the week of January 12 to 19, 1937

Day	:Breakfast	:Lunch	:Dinner	:Between meals		
Date	:	:	:	:Subject using		
Tues.	:Egg	:Peanut sandwich	:Ham	:Cookies	: L	A
Jan. 12	:Orange	:Raw carrot	:Mashed potatoes	:Cream	: L	
	:Toast	:Fruit salad	:Cabbage salad	:Coffee	: L	A
	:Butter	:Cocoa	:Gravy	:	:	
	:Coffee	:	:Ice cream	:	:	
	:Cream	:	:Cookies	:	:	
	:	:	:	:	:	
Wed.	:Orange	:Lunch ham	:Macaroni-Cheese	:Celery	: L	A
Jan. 13	:Nut roll	:Brown beans	:Tomatoes	:Coffee	: L	A
	:Milk	:Raw carrot	:Celery	:Cream	: L	
	:Coffee	:Whole wheat bread	:Whole wheat bread	:	:	
	:	:Butter	:Butter	:	:	
	:	:Ovaltine	:Fruit salad	:	:	
	:	:Cookies	:Coffee	:	:	
	:	:	:Cream	:	:	
	:	:	:Red hots	:	:	
	:	:	:	:	:	
Thurs.	:Orange	:Macaroni-Cheese	:Ham	:Ham sandwich	: L	A
Jan. 14	:Ovaltine	:Green beans	:Green beans	:Ripe olive	: L	A
	:Bread	:Celery	:Cabbage salad	:Pickle	: L	A
	:Butter	:Whole wheat bread	:Mince meat pie	:Cream	: L	
	:	:Butter	:Rolls	:Coffee	: L	A
	:	:Gooseberry sauce	:Butter	:	:	
	:	:	:Coffee	:	:	
	:	:	:Cream	:	:	
	:	:	:	:	:	

Table XI (continued)

Day	:Breakfast	:Lunch	:Dinner	:Between meals	
Date	:	:	:	:Subject using	
Fri.	:Tomato juice	:Macaroni-Cheese	:Meat-Veg. casserole	:	:
Jan. 15	:Top milk	:Rolls	:Cabbage salad	:	:
	:Coffee	:Butter	:Rolls	:	:
	:	:Ovaltine	:Oleo	:	:
	:	:Apple	:Mince meat pie	:	:
	:	:	:Coffee	:	:
	:	:	:	:	:
Sat.	:Grapefruit	:Toasted cheese	:Veg. soup	:Coffee	: L A
Jan. 16	:Sweet roll	: sandwich	:Ritz chips	:Candy	: L A
	:Cream	:Raw carrot	:Orange	:Salad	: A
	:Coffee	:Salad dressing	:Cream	:Cake	: A
	:	:Choc. cake	:Coffee	:	:
	:	:Fudge candy	:	:	:
	:	:	:	:	:
Sun.	:	:Pop corn	:Ham	:Coca cola	: L
Jan. 17	:	:Coffee	:Mashed potatoes	:	:
	:	:Cream	:Green beans	:	:
	:	:	:Gravy	:	:
	:	:	:Cabbage salad	:	:
	:	:	:Bread	:	:
	:	:	:Butter	:	:
	:	:	:Fruit salad	:	:
	:	:	:Choc. cake	:	:
	:	:	:Coffee	:	:
	:	:	:Cream	:	:
	:	:	:	:	:

Table XI (continued)

Day	:Breakfast	:Lunch	:Dinner	:Between meals	
Date	:	:	:	:Subject using	
Mon.	:Orange	:Veg. casserole	:Meat casserole	:Choc. candy	: L A
Jan. 18	:Sweet roll	:Cracked wheat	:Fried potatoes	:Ritz crackers	: A
	:Cream	: bread	:Raw carrot	:Doughnut	: A
	:Coffee	:Lettuce	:Salad dressing	:Coffee	: A
	:	:Salad dressing	:Whole wheat bread	:	:
	:	:Oleo	:Butter	:	:
	:	:Ice cream	:Ovaltine	:	:
	:	:Coffee	:Divinity candy	:	:
	:	:Cream	:	:	:
	:	:	:	:	:
	:	:	:	:	:

Table XII. Menus served during the week of January 19 to 26, 1937

Day	:Breakfast	:Lunch	:Dinner	:Between meals	
Date	:	:	:	:Subject using	
Tues.	:Grapefruit	:Potato Salad	:Brown beans with meat	:Parsnips	: L A
Jan. 19	:Doughnut	:Lettuce	:Fried parsnips	:Goodbar	: A
	:Coffee	:Whole wheat bread	:Whole wheat bread	:	:
	:Cream	:Butter	:Oleo	:	:
	:	:Tea	:Ovaltine	:	:
	:	:Cream	:Doughnut	:	:
	:	:Sugar	:Apple	:	:
	:	:	:	:	:

Table XII (continued)

Day	:Breakfast	:Lunch	:Dinner	:Between meals	
Date	:	:	:	:Subject using	
Wed.	:Orange	:Peanut butter	:Stuffed peppers	:Coffee	: L
Jan. 20	:Doughnut	: sandwich	:Sweet potatoes	:	:
	:Coffee	:Meat and veg.	:Bread	:	:
	:Cream	: casserole	:Butter	:	:
	:	:Raw carrot	:Gooseberry sauce	:	:
	:	:Salad dressing	:Cocoa	:	:
	:	:Cocoa	:	:	:
	:	:	:	:	:
Thurs.	:Orange	:Cr. Tom. soup	:Meat loaf	:Coffee	: L A
Jan. 21	:Egg	:Meat loaf	:Sweet potato	:Cream	: L
	:Toast	:Raw carrot	:Lettuce	:Apple	: L A
	:Oleo	:Ritz crackers	:Salad dressing	:	:
	:Coffee	:Coffee	:Bread	:	:
	:Cream	:Cream	:Oleo	:	:
	:	:	:Fruit jello	:	:
	:	:	:Coffee	:	:
	:	:	:Cream	:	:
	:	:	:	:	:
Fri.	:Orange	:Creamed salmon	:Beef loaf	:Candy bar	: A
Jan. 22	:Egg	:Raw carrot	:Green beans	:	:
	:Toast	:Toast	:Mashed potatoes	:	:
	:Oleo	:Fruit salad	:Gravy	:	:
	:Coffee	:Cookies	:Whole wheat bread	:	:
	:Cream	:	:Oleo	:	:
	:	:	:Peaches	:	:
	:	:	:Cookies	:	:
	:	:	:Coffee	:	:
	:	:	:Cream	:	:
	:	:	:	:	:

Table XII Continued)

Day	: Breakfast	: Lunch	: Dinner	: Between meals	
Date	:	:	:	: Subject using	
Sat.	: Peaches	: Weiner sandwich	: None	: Coffee	: L
Jan. 23	: Toast	: Pickles	:	: Cream	: L
	: Butter	: Tomato catsup	:	: Salad	: L
	: Cocoa	: Pineapple-carrot-	:	:	:
	:	: jello salad	:	:	:
	:	: Oleo	:	:	:
	:	: Cookies	:	:	:
	:	: Ice cream	:	:	:
	:	: Coffee	:	:	:
	:	: Cream	:	:	:
	:	:	:	:	:
Sun.	: None	: Banana salad	: Turkey	: Ice cream	: A
Jan. 24	:	: Sausage	: Dressing	: Cookies	: A
	:	: Waffles	: Potatoes	:	:
	:	: Butter	: Gravy	:	:
	:	: Coffee	: Tomato salad	:	:
	:	:	: Radishes	:	:
	:	:	: Bread	:	:
	:	:	: Butter	:	:
	:	:	: Cranberries	:	:
	:	:	: Ice cream	:	:
	:	:	: Coffee	:	:
	:	:	: (Not eaten by A)	:	:
	:	:	:	:	:

Table XII (continued)

Day	:Breakfast	:Lunch	:Dinner	:Between meals	
Date	:	:	:	:Subject using	
Mon.	:Banana	:Meat and veg.	:Veg. casserole	:Coffee	: L
Jan. 25	:Sausage	: casserole	:Lettuce salad	:	:
	:Egg	:Oleo	:Rolls	:	:
	:Toast	:Bread	:Oleo	:	:
	:Oleo	:Ice cream	:Ice cream	:	:
	:Coffee	:Coffee	:Cookies	:	:
	:Cream	:Cream	:Coffee	:	:
	:	:	:Cream	:	:
	:	:	:	:	:
	:	:	:	:	:

Table XIII. Menus served during the week of January 26 to February 1, 1937

Day	:Breakfast	:Lunch	:Dinner	:Between meals	
Date	:	:	:	:Subject using	
Tues.	:Prunes	:Beans-frankfurters	:Sausage	:Frankfurter	: L A
Jan. 26	:Toast	:Raw carrot	:Stuffed pepper	:Whole wheat bread:	: L A
	:Oleo	:Catsup	:Raw carrot	:Oleo	: L A
	:Cocoa	:Apple	:Salad dressing	:Candy	: L A
	:	:Coffee	:Whole wheat bread	:Coffee	: L A
	:	:Cream	:Oleo	:Cream	: L
	:	:	:Coffee	:	:
	:	:	:Cream	:	:
	:	:	:	:	:

Table XIII (continued)

Day	:Breakfast	:Lunch	:Dinner	:Between meals		
Date	:	:	:	:Subject using		
Wed.	:Grapefruit	:None	:Ham	:Cake	: L	A
Jan. 27	:Cream of Wheat	:	:Potatoes	:Coffee	: L	A
	:Toast	:	:Peas	:Cream	: L	
	:Oleo	:	:Rolls	:	:	
	:Coffee	:	:Oleo	:	:	
	:Cream	:	:Choc. tapioca	:	:	
	:Milk	:	:Coffee	:	:	
	:	:	:Cream	:	:	
	:	:	:	:	:	
Thurs.	:Grapefruit	:Creamed salmon	:Meat	:Prunes	:	A
Jan. 28	:Egg	:Cabbage salad	:Dressing	:	:	
	:Toast	:Toast	:Peas	:	:	
	:Oleo	:Choc. tapioca	:Boiled potatoes	:	:	
	:Coffee	:Coffee	:Gravy	:	:	
	:Cream	:Cream	:Bread	:	:	
	:	:	:	:	:	
Fri.	:Prunes	:Potato salad	:Ham casserole	:	:	
Jan. 29	:Pineapple roll	:Bread	:Cabbage salad	:	:	
	:Coffee	:Oleo	:Bread	:	:	
	:Cream	:Ice cream	:Oleo	:	:	
	:	:Cake	:Ice cream	:	:	
	:	:Ovaltine	:	:	:	
	:	:	:	:	:	
Sat.	:Tomato juice	:Ham sandwich	:Ham sandwich	:Divinity	: L	
Jan. 30	:Ovaltine	:Raw carrots	:Ice cream	:Choc. candy	: L	A
	:	:Salad dressing	:Cherry coca cola	:Doughnut	: L	
	:	:Apple	:Coffee	:Cookie	: L	A
	:	:Divinity	:Cream	:Caramel candy	:	A
	:	:Milk	:	:	:	

Table XIII (continued)

Day	:Breakfast	:Lunch	:Dinner	:Between meals	
Date	:	:	:	:Subject using	
Sun.	:None	:Ham	:Chicken	:Cookie	: L
Jan. 31	:	:Sweet potatoes	:Dressing	:Hamburger	: L
	:	:Green beans	:Potatoes	:Coffee	: L
	:	:Brown beans	:Gravy	:Cream	: L
	:	:Fr. rolls	:Peas	:	:
	:	:Choc. ice cream	:Bread	:	:
	:	:Apple sauce cake	:Apple sauce cake	:	:
	:	:Coffee	:Coffee	:	:
	:	:Cream	:	:	:
	:	:	:	:	:
Mon.	:Grapefruit	:Peanut butter-	:Veg. casserole	:Chicken	: L
Feb. 1	:Fr. roll	: jelly sandwich	:Whole wheat bread	:Cookie	: L A
	:Coffee	:Banana	:Apple	:Apple	: L
	:Cream	:Cookies	:Applesauce cake	:	:
	:	:	:Coffee	:	:
	:	:	:Cream	:	:
	:	:	:	:	:
	:	:	:	:	:
	:	:	:	:	:

Table XIV. Menus served during the week of February 2 to 8, 1937

Day	:Breakfast	:Lunch	:Dinner	:Between meals	:Subject using
Date	:	:	:	:	:
Tues.	:Pineapple roll	:Creamed chicken	:Salmon	:Cherry coke	: L
Feb. 2	:Cocoa	:Toast	:Toast	:	:
	:	:Apple	:Apple	:	:
	:	:Coffee	:Coffee	:	:
	:	:Cream	:Cream	:	:
	:	:	:(Not eaten by A)	:	:
	:	:	:	:	:
Wed.	:Tomato juice	:Toasted cheese	:Chili	:	:
Feb. 3	:Coffee	: sandwich	:Crackers	:	:
	:Cream	:Ice cream	:Ice cream	:	:
	:	:Coffee	:Coffee	:	:
	:	:Cream	:Cream	:	:
	:	:	:	:	:
Thurs.	:Tomato juice	:Tom.-Spaghetti	:Chili	:Crackers	: A
Feb. 4	:Coffee	:Green beans	:Crackers	:Cookies	: L A
	:Cream	:Lettuce salad	:Choc. candy	:	:
	:	:Bread	:(Not eaten by A)	:	:
	:	:Butter	:	:	:
	:	:Pecan roll	:	:	:
	:	:Cocaa	:	:	:
	:	:	:	:	:
Fri.	:Tomato juice	:Toasted cheese	:Dumplings	:Cookies	: L A
Feb. 5	:Pecan roll	: sandwich	:Green beans	:Potato salad	: L
	:Coffee	:Raw carrot	:Lettuce salad	:Potato chips	: L
	:Cream	:Banana-cream	:Bread	:Pickles	: L
	:	:Cookies	:Butter	:Liverworst sand.	: L
	:	:Coffee	:Ice cream	:Coffee	: L

Table XIV (continued)

Day	:Breakfast	:Lunch	:Dinner	:Between meals		
Date	:	:	:	:Subject using		
	:	:	:Coffee	:	:	:
	:	:	:Cream	:	:	:
	:	:	:	:	:	:
Sat.	:Tomato juice	:Creamed eggs	:Chili	:Coffee	: L	A
Feb. 6	:	:Carrot, raw	:Crackers	:Grapefruit	:	A
	:	:Toast	:Catsup	:Strawberry sundae	:	A
	:	:Salad dressing	:Coffee	:Ham sandwich	: L	
	:	:Peaches	:Cream	:Olives	: L	
	:	:Cake	:(Not eaten by A)	:Pickle	: L	
	:	:Coffee	:	:Potato chips	: L	
	:	:Cream	:	:	:	
	:	:	:	:	:	
Sun.	:Grapefruit	:Hamburger	:Turkey	:Fruit salad	:	A
Feb. 7	:	:Potato chips	:Dressing	:Cocoa	:	A
	:	:Catsup	:Potatoes	:Apple sauce cake	:	A
	:	:Coke	:Gravy	:	:	
	:	:	:Corn	:	:	
	:	:	:Rolls	:	:	
	:	:	:Salad	:	:	
	:	:	:Butter	:	:	
	:	:	:Cherry pie	:	:	
	:	:	:Sherbert	:	:	
	:	:	:Coffee	:	:	
	:	:	:Cream	:	:	
	:	:	:	:	:	

Table XIV (continued)

Day	:Breakfast	:Lunch	:Dinner	:Between meals	
Date	:	:	:	:Subject using	
Mon.	:Grapefruit	:Veg. soup	:Dumplings	:Candy	: A
Feb. 8	:Coffee	:Fruit salad	:Buttered carrots	:	:
	:Cream	:Crackers	:Bread	:	:
	:	:Iced cocoa	:Butter	:	:
	:	:	:Ice cream	:	:
	:	:	:Cake	:	:
	:	:	:Coffee	:	:
	:	:	:Cream	:	:
	:	:	:	:	:
	:	:	:	:	:

Table XV. Menus served during the week February 9 to 15, 1937

Day	:Breakfast	:Lunch	:Dinner	:Between meals	
Date	:	:	:	:Subject using	
Tues.	:Grapefruit	:Peanut butter	:Hamburger	:Cookie	: A
Feb. 9	:Pineapple roll	: sandwich	:Buttered cabbage	:	:
	:Coffee	:Lettuce salad	:Green beans	:	:
	:Cream	:Ice cream	:Gravy	:	:
	:	:Coffee	:Whole wheat bread	:	:
	:	:Cream	:Coffee	:	:
	:	:	:Cream	:	:
	:	:	:	:	:

Table XV (continued)

Day	: Breakfast	: Lunch	: Dinner	: Between meals		
Date	:	:	:	: Subject using		
Wed.	: Tomato juice	: Meat-veg. stew	: Liver	:	:	:
Feb. 10	: Egg	: Crackers	: Gravy	:	:	:
	: Toast	: Fruit salad	: Onions	:	:	:
	: Butter	: Coffee	: Whole wheat bread	:	:	:
	: Coffee	: Cream	: Ice cream	:	:	:
	: Cream	: Cookies	: Coffee	:	:	:
	:	:	: Cream	:	:	:
	:	:	:	:	:	:
Thurs.	:	: Cheese sandwich	: Potato soup	: Green river	: L	: A
Feb. 11	:	: Cabbage-fruit	: Crackers	: Coke	: L	: A
	:	: salad	: Fruit salad	: Coffee	: L	:
	:	: Ice cream	: Coffee	: Cream	: L	:
	:	: Ovaltine	: Cream	: Marshmallows	: L	:
	:	:	:	: Prunes	: L	: A
	:	:	:	:	:	:
Fri.	: Grapefruit	: Oyster soup	: Egg noodles	:	:	:
Feb. 12	: Coffee	: Celery	: Fruit salad	:	:	:
	: Cream	: Crackers	: Whole wheat bread	:	:	:
	:	: Banana	: Butter	:	:	:
	:	: Cream	: Cookies	:	:	:
	:	: Coffee	: Coffee	:	:	:
	:	:	: Cream	:	:	:
	:	:	:	:	:	:
Sat.	: Prunes	: Jello salad	:	: Apple	: L	: A
Feb. 13	: Toast	: Milk	:	: Celery	: L	: A
	: Butter	: Choc. cake	:	:	:	:
	: Coffee	: Balanas-cream	:	:	:	:
	: Cream	: Coffee	:	:	:	:
	:	: Cream	:	:	:	:

Table XV (continued)

Day	:Breakfast	:Lunch	:Dinner	:Between meals	
Date	:	:	:	:Subject using	
Sun.	:Apple	:	:Pork	:Choc. candy	: L A
Feb. 14	:	:	:Potatoes	:Ice cream	: L A
	:	:	:Raw carrot	:	:
	:	:	:Catsup	:	:
	:	:	:Spiced apple	:	:
	:	:	:Milk	:	:
	:	:	:Bread	:	:
	:	:	:	:	:
Mon.	:Grapefruit	:Veg. soup	:Pork	:Spiced apple	: L
Feb. 15	:Toast	:Raw carrot	:Potatoes	:	:
	:Butter	:Crackers	:Cabbage	:	:
	:Cocoa	:Rasp. sherbert	:Cracked wheat bread	:	:
	:	:	:Spiced apple	:	:
	:	:	:Doughnut	:	:
	:	:	:	:	:
	:	:	:	:	:

Table XVI. Menus served during the week of February 16 to 22, 1937

Day	:Breakfast	:Lunch	:Dinner	:Between meals	
Date	:	:	:	:Subject using	
Tues.	:Tomato juice	:Kraut-frankfurters	:Beef	:Candy	: L
Feb. 16	:Sweet roll	:Whole wheat bread	:Potatoes	:	:
	:Coffee	:Oleo	:Gravy	:	:
	:Cream	:Coffee	:Celery	:	:
	:	:Cream	:Tomatoes	:	:

Table XVI (continued)

Day	:Breakfast	:Lunch	:Dinner	:Between meals	
Date	:	:	:	:Subject using	
	:	:	:	:	:
	:	:Milk	:Bread	:	:
	:	:	:Butter	:	:
	:	:	:Pickles	:	:
	:	:	:Pumpkin pie	:	:
	:	:	:Apple butter	:	:
	:	:	:Candy	:	:
	:	:	:Coffee	:	:
	:	:	:Cream	:	:
	:	:	:	:	:
Wed.	:Tomato juice	:	:Hash	:Bran	: L A
Feb. 17	:Toast	:	:Salad dressing	:Cream	: L A
	:Oleo	:	:Raw carrot	:Cookie	: L
	:Cocoa	:	:Cracked wheat bread	:	:
	:	:	:Oleo	:	:
	:	:	:Ovaltine	:	:
	:	:	:Cookies	:	:
	:	:	:	:	:
Thurs.	:Grapefruit	:Bacon	:Pork	:Apples	: L
Feb. 18	:Coffee	:Kraut-frankfurters	:Beans	:Cookies	: L
	:Cream	:Beans	:Whole wheat bread	:4 Hundred	: A
	:	:Cracked wheat	:Bran	:	:
	:	: bread	:Cream	:	:
	:	:Oleo	:Candy	:	:
	:	:Ice cream	:	:	:
	:	:Cookies	:	:	:
	:	:	:	:	:

Table XVI (continued)

Day	:Breakfast	:Lunch	:Dinner	:Between meals	:Subject using
Date	:	:	:	:	:
Fri.	:Tomato juice	:Cheese sandwich	:Meat	:Strawberry pres.	: A
Feb. 19	:Egg	:Lettuce-cottage	:Sardines	:Ice cream	: L
	:Whole wheat	: cheese salad	:Brussels sprouts	:Cookies	: L
	: bread	:Cocoa	:Rolls	:Coffee	: L
	:Coffee	:	:Butter	:	:
	:Oleo	:	:Lime salad	:	:
	:Cream	:	:Ginger bread	:	:
	:	:	:(Not eaten by L)	:	:
	:	:	:	:	:
Sat.	:Tomato juice	:Pork	:Meat sandwich	:	:
Feb. 20	:Bran	:Potatoes	:Cheese	:	:
	:Milk	:Peas	:Orange	:	:
	:Coffee	:Whole wheat bread	:Tomato juice	:	:
	:Cream	:Oleo	:Coffee	:	:
	:	:Cake	:Cream	:	:
	:	:Tapioca cream	:	:	:
	:	:	:	:	:
Sun.	:Orange (L)	:Cheese sandwich	:Duck	:Coffee	: L
Feb. 21	:Tom. juice (A)	:	:Dressing	:Cake	: A
	:	:	:Potatoes	:Milk	: A
	:	:	:Gravy	:Tapioca cream	: A
	:	:	:Peas	:Meat sandwich	: L
	:	:	:Lettuce salad	:Coffee	: L
	:	:	:Cranberries	:	:
	:	:	:Bread	:	:
	:	:	:Butter	:	:
	:	:	:Coffee	:	:
	:	:	:(Not eaten by A)	:	:
	:	:	:	:	:

Table XVI (continued)

Day	:Breakfast	:Lunch	:Dinner	:Between meals	
Date	:	:	:	:Subject using	
Mon.	:	:Veal-cheese	:Pork	:Tea	: L A
Feb. 22	:	: sandwich	:Potatoes	:Cookies	: L
:	:	:Cocoa	:Banana salad	:	:
:	:	:Cake	:Bread	:	:
:	:	:	:Oleo	:	:
:	:	:	:	:	:
:	:	:	:	:	:

Table XVII. Menus served during the week of February 23 to March 1, 1937

Day	:Breakfast	:Lunch	:Dinner	:Between meals	
Date	:	:	:	:Subject using	
Tues.	:Orange	:Creamed egg	:Hamburger	:Apple	: L
Feb. 23	:Sweet roll	:Toast	:Gravy	:	:
	:Cocoa	:Banana salad	:Potatoes	:	:
	:	:Cake	:Whole wheat bread	:	:
	:	:	:Oleo	:	:
	:	:	:Fruit cup	:	:
	:	:	:Cake	:	:
	:	:	:Coffee	:	:
	:	:	:	:	:
Wed.	:Tomato juice	:Bacon	:Potato soup	:Coffee	: L
Feb. 24	:Bran	:Beans	:Crackers	:Cream	: L
	:Cream	:Graham bread	:Pickles	:Apple	: A
	:Coffee	:Butter	:Celery	:	:
	:Milk	:Ice cream	:Cake	:	:

Table XVII (continued)

Day	:Breakfast	:Lunch	:Dinner	:Between meals	
Date	:	:	:	:Subject using	
	:	:Cocoa	:	:	:
	:	:	:	:	:
Thurs.	:Apple	:Bacon	:Gooseliver sandwich	:	:
Feb. 25	:Sweet roll	:Beans	:Potato chips	:	:
	:Coffee	:Pickles	:Tomato salad	:	:
	:Cream	:Bread	:Olives	:	:
	:	:Butter	:Pickles	:	:
	:	:Pickled peaches	:Choc. sundae	:	:
	:	:Coffee	:Coffee	:	:
	:	:Cream	:Cream	:	:
	:	:	:Nuts	:	:
	:	:	:	:	:
Fri.	:Apple	:Bacon	:Mackerel	:Coffee	: L
Feb. 26	:Toast	:Beans	:Fried potatoes	:Cream	: L
	:Butter	:Frankfurters	:Carrot-lettuce salad	:Goodbar	: L A
	:Coffee	:Raw carrots	:Bread	:	:
	:Cream	:Catsup	:Butter	:	:
	:	:White bread	:Cocoa	:	:
	:	:Butter	:	:	:
	:	:Pickled peaches	:	:	:
	:	:Coffee	:	:	:
	:	:	:	:	:
Sat.	:None	:Roast beef	:Beef	:Steak sandwich	: L
Feb. 27	:	:Potatoes	:Lettuce	:Coffee	: L
	:	:Corn	:Bread	:Cream	: L
	:	:Gravy	:Cake	:	:
	:	:Lettuce	:Choc. Milk	:	:
	:	:Apricots	:(Not eaten by L)	:	:
	:	:Choc. cake	:	:	:

Table XVII (continued)

Day	:Breakfast	:Lunch	:Dinner	:Between meals	:Subject using
Date	:	:	:	:	:
	:	:Coffee	:	:	:
	:	:Cream	:	:	:
	:	:	:	:	:
Sun.	:None	:Mackerel sand.	:Gooseliver sandwich	:Coffee	:A
Feb. 28	:	:Potato salad	:Potato chips	:	:
	:	:Carrot	:Tomatoes	:	:
	:	:Roll	:Coffee	:	:
	:	:	:Olives	:	:
	:	:	:Cream	:	:
	:	:	:Coke	:	:
	:	:	:(Not eaten by A)	:	:
	:	:	:	:	:
Mon.	:Apple	:Veg. soup	:Liver	:	:
Mar. 1	:Toast	:Crackers	:Onions	:	:
	:Butter	:Milk	:Potatoes	:	:
	:Cocoa	:Coffee	:Gravy	:	:
	:	:Cream	:Cabbage salad	:	:
	:	:Ice cream	:Banana jello	:	:
	:	:Cookies	:	:	:
	:	:	:	:	:
	:	:	:	:	:
	:	:	:	:	:

Table XVIII. Menus served during the week of March 2 to 8, 1937

Day	:Breakfast	:Lunch	:Dinner	:Between meals		
Date	:	:	:	:Subject using		
Tues.	:Grapefruit	:Pineapple	:Cr. Tom. soup	:Grape soda	: L	
Mar. 2	:Bran	:Cookies	:Crackers	:Pineapple		A
	:Milk	:	:Pineapple juice (L)	:		
	:Coffee	:	:Caramel candy	:		
	:Cream	:	:Strawberry soda (A)	:		
Wed.	:Grapefruit	:Peanut butter-	:Beef steak	:		
Mar. 3	:Egg	: jelly sandwich	:Potatoes	:		
	:Bread	:Ovaltine	:Cabbage	:		
	:Butter	:Coffee	:Gravy	:		
	:Coffee	:Cream	:Bread	:		
	:Cream	:	:Butter	:		
	:	:	:Fruit salad	:		
	:	:	:	:		
Thurs.	:Grapefruit	:Potato salad	:Hamburger	:Honey-almond	: L	A
Mar. 4	:Cream of Wheat	:Bread	:Gravy	:Grape juice	: L	A
	:Milk	:Butter	:Breaded tomatoes	:		
	:Toast	:Fruit salad	:Potato salad	:		
	:Butter	:	:Raw carrot	:		
	:Coffee	:	:Apple	:		
	:	:	:Coffee	:		
	:	:	:Cream	:		
	:	:	:	:		
Fri.	:Grapefruit	:Cheese sandwich	:Frankfurters	:Cherry coke	: L	A
Mar. 5	:Egg	:Pineapple	:Cabbage	:Bran	: L	A
	:Toast	:Cookies	:Bread	:Cream	: L	A
	:Butter	:Baby Ruth candy	:Catsup	:		

Table XVIII (continued)

Day	:Breakfast	:Lunch	:Dinner	:Between meals	
Date	:	:	:	:Subject using	
	:Coffee	:Cocoa	:Blackberries	:	:
	:Cream	:	:	:	:
	:	:	:	:	:
Sat.	:Grapefruit	:Lunch ham	:Fried chicken	:Bread	: A
Mar. 6	:Toast	:Milk	:Potatoes	:Butter	: A
	:Butter	:Banana (A)	:Tomatoes	:Jelly	: A
	:Coffee	:	:Lima Beans	:Banana	: A
	:	:	:Bread	:Coffee	: A
	:	:	:Gravy	:	:
	:	:	:Butter	:	:
	:	:	:Fruit cup	:	:
	:	:	:(Not eaten by A)	:	:
	:	:	:	:	:
Sun.	:None	:None	:Steak	:Ice cream	: L
Mar. 7	:	:	:Gravy	:Caramel candy	: L A
	:	:	:Potatoes	:	:
	:	:	:Lettuce-bean salad	:	:
	:	:	:Coffee	:	:
	:	:	:Cream	:	:
	:	:	:	:	:
Mon.	:Tomato juice	:Creamed beef	:Lunch ham	:Pickles	: L
Mar. 8	:Toast	:Toast	:Fried potatoes	:	:
	:Butter	:Pickles	:Green beans	:	:
	:Coffee	:	:Tomatoes	:	:
	:Cream	:	:Lettuce salad	:	:
	:	:	:Sherbert	:	:
	:	:	:Nut rolls	:	:
	:	:	:Coffee	:	:
	:	:	:Cream	:	:
	:	:	:	:	:

Table XIX. Frequency distribution of certain foods in the diet

	Sub-ject	Vegetables: green or yellow	Fruits: Citrus (1) Other	Whole grain products	Meat, fish, poultry	Eggs	Coffee, tea, coca cola	Milk	Ice cream	Eating between meals	
Total times occurring	L	71	52	51	34	64	10	124	31	17	47
Average per day		1.3	0.9	0.9	0.6	1.1	0.2	2.2	0.55	0.2	0.8
Total times occurring	A	69	43	48	33	49	12	83	39	21	40
Average per day		1.2	0.8	0.8	0.6	0.9	0.2	1.5	0.68	0.4	0.7

(1) Including tomatoes.

CONCLUSIONS

The two college women consumed fewer Calories daily than the amount commonly recommended.

Milk and eggs were included in the diet less frequently than the accepted standards for these foods.

Appetite was apparently a factor in the food habits of each subject.

Although judgment cannot be passed upon the adequacy of the diet as a whole without further analyses, the study does indicate that the protein intake was probably sufficient while the energy content was considerably lower than the usually accepted standard for this nutrient. It suggests a need for further study with the idea of a possible revision of present-day energy standards for this age group.

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