THE RELATIVE CONTRIBUTION OF THE STAPLE COMMODITIES TO THE NATIONAL FOOD CONSUMPTION.[1]

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The purpose of this paper is to present a part of the more important results of a detailed and comprehensive investigation of the food resources and utilization of the United States. The complete study will appear presently in another form, and then the supporting data on which the results here presented are based will be available. Only the final results as to *consumption of human food* will be given in the present communication.

It is quite impossible to present here any account of the critical precautions used to ensure accuracy, nor can the details of how the final results on consumption were arrived at be given in this brief paper. It is hoped that the indulgence of the reader will be granted until the appearance of the complete publication,[2] where all the details are set forth.

I. The Plan.

The basis of any adequate survey of food resources must be essentially physiological, rather than one of commodities or trade. Broadly speaking the ultimate sources of food are the soil and the sun. The energy derived from the sun through the mechanism of the green plant builds up the inorganic chemical elements of the soil, air, and water into compounds which can be utilized as food by man, either directly or secondarily in the form of the products of animals which have been nourished on the primary foods of the plant world.

For the purpose of statistical analysis all nutritive materials pro-

[1] Papers from the Department of Biometry and Vital Statistics, School of Hygiene and Public Health, Johns Hopkins University, No. 4.

[2] Pearl, R., "The Nation's Food." In process of publication by the W. B. Saunders Co., Philadelphia.

duced and consumed fall into one or another of the following categories, which are obviously based on the considerations set forth in the preceding paragraph.

I. *Primary Foods.* Including all plant materials used as human food or fractions of such materials, and all animals or animal products in which the animal gets its nourishment from some source other than the primary feeds and fodders as defined below, either

(*a*) Directly as harvested, with only such sophistication as comes from cooking, such as, for example, potatoes, fish, oysters.

(*b*) In derivative form, where by process of manufacture a food product is prepared from a raw plant product; such as, for example, wheat flour or cottonseed oil.

II. *Primary Feeds or Fodders.* Including all plant materials or fractions of such materials used for the nourishment of domestic animals, either

(*a*) Directly as harvested, such as the coarse grains, or

(*b*) In derivative or manufactured form, such as manufactured feeds.

III. *Secondary Foods.* Including all edible products of animals used for human food nourished with primary feeds and fodders, including both produced,

(*a*) Directly, without involving the death of the producing animal, such as, for example, honey, eggs, or milk, and

(*b*) Derivatively, involving the death of the animal, such as, for example, the meats.

The basic idea in this classification is, of course, to allocate the nutrient resources of the nation according to the usage made of them. We have certain products of the soil, and of the seas and fresh water lakes and streams, which are directly produced and directly consumed as human food. To produce a crop of potatoes or of cod fish or oysters it is not necessary to feed out to the growing crop some other crop such as hay or grain. Therefore these are direct, primary food products. On the other hand there are many foods such as the meats, eggs, etc., where to obtain a pound of protein, or fat, or carbohydrate for human consumption it is necessary

to use a certain amount of other protein, fat, and carbohydrate primarily produced as fodder or feed. Human food produced in this manner is obviously secondarily produced and cannot be allowed to count in the net nutritive balance sheet on the same basis as the primarily produced food. It is a relatively more expensive form of nourishment.

It is evident that under this classification many raw food materials will of necessity fall in part into two or more categories. For example, to take the case of wheat, the major part of the raw grain is ground into flour and as such used as human food, but in the process of making the flour there is produced a certain amount of feeding stuffs, bran, middlings, etc., which only indirectly contribute to human nutrition through the products of animals which eat these wheat feeds. Finally a certain small proportion of the wheat grain is fed directly as such to livestock. Similar considerations apply to very many other food materials. That all this adds a considerable complexity to the problem is evident. But it is equally clear that if anything approaching reliability in the final result is to be attained, due regard must be paid to these complicated subdivisions in usage of the raw food materials. Otherwise the same nutritive material will be duplicated in the accounting and a misleading result reached.

The general plan of this study has been first to determine as accurately as possible from existing official statistics for each year from 1911–12 to 1917–18, inclusive, the amount of the basic nutrients, protein, fat and carbohydrate: (*a*) produced, (*b*) imported, (*c*) exported, classifying the results under the main headings given above. From this tabulation as a base one may then proceed to calculations of consumption.

In all cases where investigation showed it to be necessary deductions were made for the following kinds of reasons:

(*a*) Loss of commodity in storage.
(*b*) Spoilage of commodity in storage.
(*c*) Loss of commodity in transit.
(*d*) Spoilage of commodity in transit.
(*e*) Loss by vermin.
(*f*) Amount fed to livestock.
(*g*) Amount used for technical, non-food purposes, including the manufacture of alcoholic beverages.

(*h*) Inedible refuse.

The effort was made, in the most careful and critical manner possible, to have the final figures for human food consumption represent *net* values. It is believed that this desideratum has been substantially attained. In the complete report of the study detailed statements regarding the steps taken to get net values will be given.

In making up the basic tables each commodity or derivative of a commodity was listed separately and converted as such into nutrient values. In the matter of units of measure the following general plan was followed: In all basic tables the quantities of production, export and import are first given in the American units (bushels, pounds, gallons, etc.) of the original statistics. These quantities were then all converted into metric tons.[3] All nutrient values, protein, fat, and carbohydrate are given in metric tons. Energy values are expressed in millions of small calories.[4]

Regarding the sources of the basic statistics the following general statement may be made here.[5] For *production* figures the fundamental sources, in the case of primary products, are the successive *Year Books* of the U. S. Department of Agriculture. Each volume of this publication carries as an appendix statistical tables giving the Department's official figures of crop production. A secondary source for crop production figures is found in the successive volumes of the *Monthly Crop Report* of the U. S. Department of Agriculture. Its figures are again official and form the basis of the tabulation of the *Year Book,* but frequently give more detailed information. Reliable statistics of the derivative products such as flour, meals, etc., are much more difficult to obtain than crop production figures, for the reason that they are not officially collected and published. In this field resort has been had to a variety of sources, such as trade papers, census returns, special *ad hoc* inquiries of manufacturers, etc.

Export and import figures were taken from the official reports (annual and monthly) of the foreign commerce of the United

[3] The metric ton = 2204.6 lbs.

[4] A small calory is the amount of heat necessary to raise 1 gram of water 1° Centigrade.

[5] This statement is supplemented by more detailed source references in the complete report of the work.

States compiled by the Department of Commerce. In a few cases where it has been clear from information available to the Food Administration that the official figures of the Department of Commerce were in error we have not hesitated to use other and, we believe, more correct statistics, but in each such case specific notation of the fact is made in the detailed report.

In the computation of nutrient values use has been made chiefly of the factors given by Atwater and Bryant.[6] It has been necessary, in some cases, to supplement their tables from data given by Leach[7] and Henry and Morrison.[8]

All calculations in this work have been repeatedly checked and every possible precaution taken to guard against error. It is too much to hope that so extensive a piece of statistical work should be without errors, but I hope that their number is small and their net significance in the final results negligible.

II. The Consumption of Human Food in the United States.

Hitherto there have been available only the roughest guesses as to the total domestic consumption of all but a few items of food, such as wheat and sugar. If anyone were confronted with the naïve and simple question, "How much corn, or oats, or molasses, or fish, or milk, or nuts," or any one of a long series of other foods, "is consumed annually in the United States as human food," no accurate answer could be given. Yet the question is obviously a fair one, and one which somebody in the nation ought to be able to answer with a considerable degree of accuracy. For some twenty-odd great staple commodities or groups of like commodities we are now in a position to present figures of a relatively high degree of accuracy as to consumption. On the basis of these figures it is possible to discuss effectively many interesting and important problems; such as, for example, that of the relative importance of great

[6] Atwater, W. O., and Bryant, A. P., "The Chemical Composition of American Food Materials" (Corrected April 14, 1906), U. S. Dept. Agr. Office of Expt. Sta. Bulletin 28 (revised edition), 1906.

[7] Leach, A. E., "Food Inspection and Analysis." Third edition, revised and enlarged by A. L. Winton, New York, 1913.

[8] Henry, W. A., and Morrison, F. B., "Feeds and Feeding." Sixteenth edition. Madison, 1916.

TABLE I.

THE CONSUMPTION OF HUMAN FOODS IN THE UNITED STATES, 1911 TO 1918
(METRIC TONS).

Commodity.	1911–12.				1912–13.			
	Protein in Metric Tons.	Fat in Metric Tons.	Carbohydrate in Metric Tons.	Calories in Millions.	Protein in Metric Tons.	Fat in Metric Tons.	Carbohydrate in Metric Tons.	Calories in Millions.
Grains and Derivative Products								
Wheat and products	1,000,730	87,132	6,589,209	31,933,764	995,249	86,726	6,553,141	31,759,774
Corn products	205,809	99,607	1,831,949	9,283,484	203,748	98,245	1,814,153	9,189,386
Rye products	10,215	1,351	118,242	539,899	10,701	1,416	123,843	565,476
Rice and products	13,472	338	133,036	605,503	15,840	397	156,420	711,928
Other cereals	26,728	10,457	150,341	824,114	26,114	10,293	145,068	798,429
Sub-total—Grains	1,256,954	198,885	8,822,777	43,186,764	1,251,652	197,077	8,792,625	43,024,993
Vegetables								
Legumes	66,717	4,619	174,915	1,034,622	70,279	4,830	184,215	1,089,145
Potatoes	100,861	5,604	823,688	3,843,272	136,412	7,578	1,114,025	5,197,962
Other vegetables	28,662	9,607	282,235	1,367,003	29,537	9,682	285,777	1,385,885
Sub-total—Vegetables	196,240	19,830	1,280,838	6,244,897	236,228	22,090	1,584,017	7,672,992
Sugars	454	0	3,906,511	16,021,424	455	0	4,104,958	16,835,176
Fruits								
Apples	8,646	8,500	309,136	1,388,209	9.519	9,406	341,068	1,531,633
Oranges	1,571	392	30,223	132,398	1,589	397	30,558	133,866
Bananas	7,575	3,788	121,214	563,684	7,219	3,609	115,509	537,156
Other fruits	6,492	7,173	151,684	710,188	8,171	7,288	184,418	851,392
Sub-total—Fruits	24,284	19,853	612,257	2,794,479	26,498	20,700	671,553	3,054,047

TABLE I.—(*Continued.*)

THE CONSUMPTION OF HUMAN FOODS IN THE UNITED STATES, 1911 TO 1918 (METRIC TONS).

Commodity.	1911–12.				1912–13.			
	Protein in Metric Tons.	Fat in Metric Tons.	Carbohydrate in Metric Tons.	Calories in Millions.	Protein in Metric Tons.	Fat in Metric Tons.	Carbohydrate in Metric Tons.	Calories in Millions.
Vegetable Oils and Nuts								
Nuts	40,460	77,555	30,491	1,012,435	43,369	81,228	32,932	1,068,492
Vegetable oils	0	464,403	0	4,321,063	0	458,136	0	4,262,661
Chocolate and cocoa	8,312	19,470	16,242	280,323	7,978	18,676	15,593	268,987
Sub-total—Oils and Nuts	48,772	561,428	46,733	5,613,821	51,347	558,040	48,525	5,600,140
Fish	86,948	19,176	20	552,810	85,016	18,477	20	538,436
Sub-total—All primary	1,613,652	819,172	14,669,136	74,414,195	1,651,196	816,384	15,201,698	76,725,784
Meats and Meat Products								
Beef and products	546,104	516,545	1,725	7,072,130	521,798	496,439	1,649	6,784,205
Pork and products	388,745	1,963,696	2,664	19,874,512	381,901	1,926,270	2,597	19,498,083
Mutton and products	45,782	61,465	521	762,158	48,677	70,612	542	859,246
Sub-total—Meats	979,981	2,541,621	4,891	27,705,272	951,570	2,494,770	4,766	27,151,638
Poultry and Eggs	235,699	165,906	0	2,508,307	239,584	168,659	0	2,549,776
Oleomargarine	680	47,038	0	440,412	774	53,539	0	501,291
Dairy Products	726,604	1,368,995	880,525	19,337,072	720,632	1,358,126	872,694	19,179,262
Sub-total—All secondary	1,942,964	4,123,560	885,416	49,991,063	1,912,560	4,075,094	877,460	49,381,967
Grand Total	3,556,616	4,942,732	15,554,552	124,405,258	3,563,756	4,891,478	16,079,158	126,107,751

TABLE I.—(*Continued.*)

THE CONSUMPTION OF HUMAN FOODS IN THE UNITED STATES, 1911 TO 1918

(METRIC TONS).

Commodity.	1913–14.				1914–15.			
	Protein in Metric Tons.	Fat in Metric Tons.	Carbohydrate in Metric Tons.	Calories in Millions.	Protein in Metric Tons.	Fat in Metric Tons.	Carbonydrate in Metric Tons.	Calories in Millions.
Grains and Derivative Products								
Wheat and products	1,166,243	101,745	7,679,047	37,217,595	978,806	85,316	6,446,223	31,240,761
Corn products	202,368	97,263	1,802,353	9,126,239	201,503	96,571	1,795,051	9,086,301
Rye products	11,173	1,479	129,304	590,413	11,228	1,486	129,936	593,297
Rice and products	18,636	465	184,022	837,569	13,427	337	132,597	603,495
Other cereals	29,981	12,119	158,441	885,682	28,572	11,601	149,850	840,310
Sub-total—Grains	1,428,401	213,071	9,953,167	48,657,498	1,233,536	195,311	8,653,657	42,364,164
Vegetables								
Legumes	76,757	5,282	202,149	1,193,370	68,833	4,869	179,423	1,063,900
Potatoes	108,850	6,046	888,931	4,147,685	132,339	7,353	1,080,780	5,042,836
Other vegetables	28,605	9,178	286,216	1,379,545	33,441	10,126	304,815	1,484,680
Sub-total—Vegetables	214,212	20,506	1,377,296	6,720,600	234,613	22,348	1,565,018	7,591,416
Sugars	455	0	4,423,200	18,140,160	455	0	4,319,726	17,715,852
Fruits								
Apples	5,792	5,701	207,210	930,502	10,256	10,141	367,567	1,650,637
Oranges	1,526	381	29,358	128,607	1,499	374	28,839	126,340
Bananas	8,222	4,111	131,567	611,836	6,914	3,447	110,304	512,951
Other fruits	6,656	7,608	150,045	708,077	7,878	6,607	169,753	783,643
Sub-total—Fruits	22,196	17,801	518,180	2,379,022	26,547	20,569	676,463	3,073,571

TABLE I.—(*Continued.*)

THE CONSUMPTION OF HUMAN FOODS IN THE UNITED STATES, 1911 TO 1918

(METRIC TONS.)

Commodity.	1913–14.				1914–15.			
	Protein in Metric Tons.	Fat in Metric Tons.	Carbohydrate in Metric Tons.	Calories in Millions.	Protein in Metric Tons.	Fat in Metric Tons.	Carbonyhydrate in Metric Tons.	Calories in Millions.
Vegetable Oils and Nuts								
Nuts	50,244	95,092	38,381	1,247,995	50,929	95,096	38,400	1,250,900
Vegetable oils	0	541,477	0	5,038,094	0	595,041	0	5,536,504
Chocolate and cocoa	10,200	23,885	19,931	343,932	9,195	21,574	17,954	310,281
Sub-total—Oils and Nuts	60,444	660,454	58,312	6,630,021	60,124	711,711	56,354	7,097,685
Fish	86,108	18,563	18	543,899	86,796	18,732	19	548,479
Sub-total—All primary	1,811,816	930,395	16,330,173	83,071,200	1,642,071	968,671	15,271,237	78,391,167
Meats and Meat Products								
Beef and products	507,758	486,631	1,583	6,634,517	508,717	490,365	1,662	6,673,341
Pork and products	364,500	1,855,128	2,482	18,764,355	416,899	2,157,916	2,873	21,797,474
Mutton and products	48,684	77,397	535	922,389	42,256	64,254	462	773,384
Sub-total—Meats	920,379	2,419,465	4,586	26,321,773	967,165	2,707,408	4,980	29,193,531
Poultry and Eggs	244,965	172,484	0	2,607,319	249,006	175,349	0	2,650,480
Oleomargarine	770	53,261	0	498,672	765	52,917	0	495,467
Dairy Products	731,613	1,379,896	884,160	19,473,916	742,130	1,400,492	903,312	19,787,471
Sub-total—All secondary	1,897,727	4,025,106	888,746	48,901,680	1,959,066	4,336,166	908,292	52,126,949
Grand Total	3,709,543	4,955,501	17,218,919	131,972,880	3,601,137	5,304,837	16,179,529	130,518,116

TABLE I.—(*Continued.*)

THE CONSUMPTION OF HUMAN FOODS IN THE UNITED STATES, 1911 TO 1918
(METRIC TONS.)

Commodity.	1915–16.				1916–17.				1917–18.			
	Protein in Metric Tons.	Fat in Metric Tons.	Carbohydrate in Metric Tons.	Calories in Millions.	Protein in Metric Tons.	Fat in Metric Tons.	Carbohydrate in Metric Tons.	Calories in Millions.	Protein in Metric Tons.	Fat in Metric Tons.	Carbohydrate in Metric Tons.	Calories in Millions.
Grains and Derivative Products												
Wheat and products	1,159,286	101,146	7,636,118	37,007,387	1,026,976	89,506	6,765,024	32,784,510	940,543	81,835	6,195,182	30,021,979
Corn products	201,163	96,173	1,792,381	9,070,259	201,709	96,269	1,797,497	9,094,401	242,395	118,845	2,155,310	10,938,521
Rye products	11,480	1,519	132,856	606,633	12,245	1,621	141,725	647,129	24,597	3,256	284,668	1,299,820
Rice and products	16,677	417	164,691	749,578	25,331	634	250,140	1,138,508	30,725	767	303,428	1,381,039
Other cereals	32,131	13,292	161,941	920,265	39,298	16,587	189,036	1,091,501	65,088	23,104	352,857	1,927,964
Sub-total—Grains	1,420,737	212,547	9,887,987	48,354,122	1,305,559	204,617	9,143,422	44,756,049	1,303,348	227,807	9,291,445	45,569,323
Vegetables												
Legumes	59,707	4,145	153,757	913,944	75,821	5,200	198,157	1,172,609	105,578	7,325	277,203	1,638,716
Potatoes	115,422	6,412	942,629	4,398,237	93,703	5,205	765,232	3,570,508	143,167	7,953	1,169,204	5,455,418
Other vegetables	32,292	10,998	346,643	1,660,414	28,284	10,021	317,522	1,514,539	36,668	12,586	398,275	1,904,998
Sub-total—Vegetables	207,321	21,555	1,443,029	6,972,595	197,808	20,426	1,280,911	6,257,656	285,413	27,864	1,844,682	8,999,132
Sugars	455	0	4,047,276	16,598,665	455	0	4,356,901	17,868,295	439	0	4,374,194	17,939,129
Fruits												
Apples	9,610	9,567	345,335	1,550,836	8,490	8,461	305,219	1,370,683	7,458	7,451	268,425	1,205,454
Oranges	1,523	379	29,286	128,293	2,176	544	41,912	183,597	1,109	278	21,360	93,569
Bananas	6,169	3,085	98,717	459,065	5,778	2,889	92,457	429,960	5,771	2,885	92,328	429,360
Other fruits	9,295	9,174	206,025	961,649	7,227	8,429	167,517	790,038	9,283	6,767	219,237	994,221
Sub-total—Fruits	26,597	22,205	679,363	3,099,843	23,671	20,323	607,105	2,774,278	23,621	17,381	601,350	2,722,604

TABLE I.—(*Concluded.*)

THE CONSUMPTION OF HUMAN FOODS IN THE UNITED STATES, 1911 TO 1918

(METRIC TONS.)

Commodity.	1915–16.				1916–17.				1917–18.			
	Protein in Metric Tons.	Fat in Metric Tons.	Carbohydrate in Metric Tons.	Calories in Millions.	Protein in Metric Tons.	Fat in Metric Tons.	Carbohydrate in Metric Tons.	Calories in Millions.	Protein in Metric Tons.	Fat in Metric Tons.	Carbohydrate in Metric Tons.	Calories in Millions.
Vegetable Oils and Nuts												
Nuts	47,957	99,492	36,507	1,271,900	47,957	105,623	36,717	1,329,746	81,939	179,337	63,054	2,262,988
Vegetable oils	0	424,858	0	3,953,026	0	547,294	0	5,092,191	0	554,851	0	5,162,528
Chocolate and cocoa	11,880	27,881	23,200	400,975	18,554	43,530	36,235	626,117	20,083	47,273	39,177	678,641
Sub-total—Oils and Nuts	59,837	552,231	59,707	5,625,901	66,511	696,447	72,952	7,048,054	102,022	781,461	102,231	8,104,157
Fish	79,968	16,045	20	495,706	84,275	17,582	23	527,725	85,021	17,866	25	533,419
Sub-total—All primary	1,794,915	824,583	16,117,382	81,146,832	1,678,279	959,395	15,461,314	79,232,057	1,799,864	1,072,379	16,213,927	83,867,764
Meats and Meat Products												
Beef and products	525,129	502,065	1,740	6,850,539	562,748	538,151	1,881	7,342,374	539,703	513,596	1,577	7,017,398
Pork and products	405,161	2,143,483	2,929	21,614,254	398,781	2,098,923	2,895	21,173,213	378,799	2,045,653	2,859	20,594,616
Mutton and products	40,286	62,637	439	750,130	36,589	56,626	406	678,884	28,298	46,853	315	553,498
Sub-total—Meats	969,077	2,700,434	5,076	29,136,535	996,527	2,685,983	5,146	29,115,663	945,277	2,602,187	4,717	28,122,722
Poultry and Eggs	252,314	177,696	0	2,685,822	255,499	179,999	0	2,720,161	248,772	175,220	0	2,648,262
Oleomargarine	800	55,375	0	518,470	1,238	85,658	0	802,005	1,808	125,024	0	1,170,593
Dairy Products	764,377	1,445,669	919,595	20,366,131	783,350	1,482,331	937,858	20,860,208	788,969	1,505,129	917,169	21,010,397
Sub-total—All secondary	1,986,568	4,379,174	924,671	52,706,958	2,036,614	4,433,971	943,004	53,498,037	1,984,826	4,407,560	921,886	52,951,974
Grand Total	3,781,483	5,203,757	17,042,053	133,853,790	3,714,893	5,393,366	16,404,318	132,730,094	3,784,690	5,479,939	17,135,813	136,819,728

groups of staples, like the grains and the vegetables, in the nutrition of the people of the nation. We can calculate with accuracy the total national food bill, and so forth.

The final net results as to consumption of human foods in the United States during the seven years are set forth in Table I. In that table the results are given for the several nutrient values, protein, fat, carbohydrate and calories, only. This is the most scien-

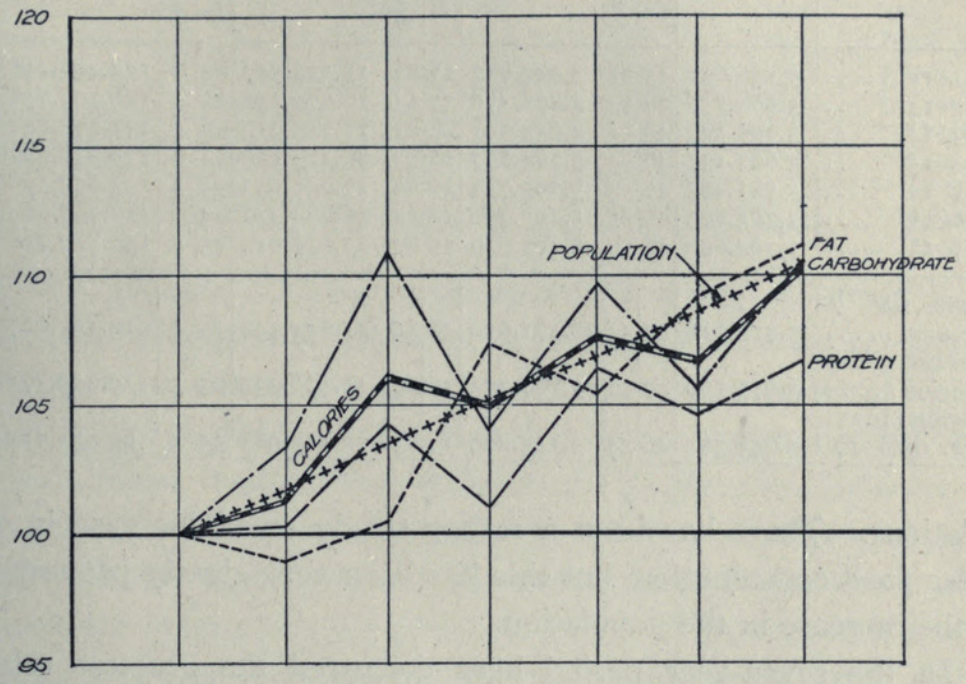

FIG. 1. Relative curves for human food consumption. The figure for the year 1911–12 is taken as 100 in each case and the relative figure for each year calculated to that base.

tific, and as soon as one become accustomed to it, by far the most useful way of thinking about food consumption.

The data of Table I. are summarized by years in Table II., and are shown graphically in relative form in Fig. 1.

The first thing which impresses one about the consumption figures is their extreme uniformity from year to year, as compared with production, exports and imports. This is exactly what would be expected, of course. No matter how much production, exports and imports may fluctuate, within wide limits, the people of this country eat about the same amount each year. To have the statistical calculation come out to this result so beautifully is strong evidence of the correctness of the long and tedious preliminary cal-

TABLE II.

SUMMARY OF CONSUMPTION OF HUMAN FOODS, PRIMARY AND SECONDARY (METRIC TONS).

	Protein.	Per Cent. from		Fat.	Per Cent. from		Carbohydrate.	Per Cent. from		Calories (Millions).	Per Cent. from	
		Primary.	Secondary.		Primary.	Secondary.		Primary.	Secondary.		Primary.	Secondary.
1911–12.....	3,556,616	45	55	4,942,732	17	83	15,554,552	94	6	124,405,258	60	40
1912–13.....	3,563,756	46	54	4,891,478	17	83	16,079,158	95	5	126,107,751	61	39
1913–14.....	3,709,543	49	51	4,955,501	19	81	17,218,919	95	5	131,972,880	63	37
1914–15.....	3,601,137	46	54	5,304,837	18	82	16,179,529	94	6	130,518,116	60	40
1915–16.....	3,781,483	47	53	5,203,757	16	84	17,042,053	95	5	133,853,790	61	39
1916–17.....	3,714,893	45	55	5,393,366	18	82	16,404,318	94	6	132,730,094	60	40
1917–18.....	3,784,690	48	52	5,479,939	20	80	17,135,813	95	5	136,819,738	61	39
Total for 7 years.....	25,712,118	47	53	36,171,610	18	82	115,614,342	95	5	916,407,627	61	39
Average, whole period.....	3,673,160	47	53	5,167,373	18	82	16,516,335	95	5	130,915,375	61	39
Average, 1911–12, 1916–17	3,654,571	46	54	5,115,279	17	83	16,413,088	95	5	129,931,315	61	39

culations. There has been a rather steady small increase in total gross food consumption, but this has been very closely proportional to the increase in the population.

In the seven-year period here discussed the greatest relative advance in consumption was in respect of fat, and the least relative advance in respect of protein. Carbohydrate content and calories increased in the seven years in amount consumed to a degree intermediate between fat and protein. The protein relative line falls below the population relative line each year after 1913–14. This means that since 1913–14 somewhat less protein has been consumed in gross in proportion to the population. The relative line for fat was below the population line till 1914–15, and thereafter followed it closely.

The relative figures from which Fig. 1 is plotted are given in Table III.

With such gratifying assurance of the smoothness of the consumption results we may proceed to an analytical discussion of the numerous highly interesting problems which center about human food consumption, and for which data have hitherto been lacking.

TABLE III.

CONSUMPTION OF HUMAN FOODS, PRIMARY AND SECONDARY, RELATIVE TO 1911–12, TAKEN AS 100.

	Population.	Protein.	Fat.	Carbohydrate.	Calories (Millions).
1911–12	100.0	100.0	100.0	100.0	100.0
1912–13	101.7	100.2	99.0	103.4	101.4
1913–14	103.4	104.3	100.3	110.7	106.1
1914–15	105.1	101.3	107.3	104.0	104.9
1915–16	106.8	106.3	105.3	109.6	107.6
1916–17	108.5	104.5	109.1	105.5	106.7
1917–18	110.2	106.4	110.9	110.2	110.0
Average, whole period	105.1	103.3	104.6	106.2	105.2
Average, 1911–12 to 1916–17	104.3	102.8	103.5	105.5	104.5

The first of such problems to which attention may be turned is: To what relative degree do primary, as distinguished from secondary, human foods contribute to the total nutritional intake of our population? From Table II. it is seen that of the protein consumed 47 per cent. comes from primary sources and 53 per cent. from secondary sources. Thus, broadly speaking, the American people get over one half of their protein from animal sources exclusive of fish, which are included in the primary foods. This fact indicates at once the importance of maintaining our animal herds intact and keeping the price of animal products at not too high a level, unless we are prepared to face the alternative of a radical and fundamental alteration in the established dietary habits of the people.

In general there has been but little change in this protein-source dietary habit in the seven years included in this study. What change there has been is in the direction of a smaller proportion of protein from secondary sources and a larger from primary, but the movement has been but slight. As would be expected, a much larger proportion of the total fat consumed in human food comes from secondary sources than is the case with protein. The figures are 82 per cent. from secondary sources and 18 per cent. from primary. Again there has been little change in the seven years. In spite of all propaganda from dietary cranks and from commercial interests, it is clear that the American people depend to an overwhelming degree upon animal sources for their fat intake, rather

than upon vegetable oils, nuts and the like. This condition is naturally reversed as regards carbohydrate. Ninety-four per cent. of this nutrient comes from primary sources and only 5 from second-

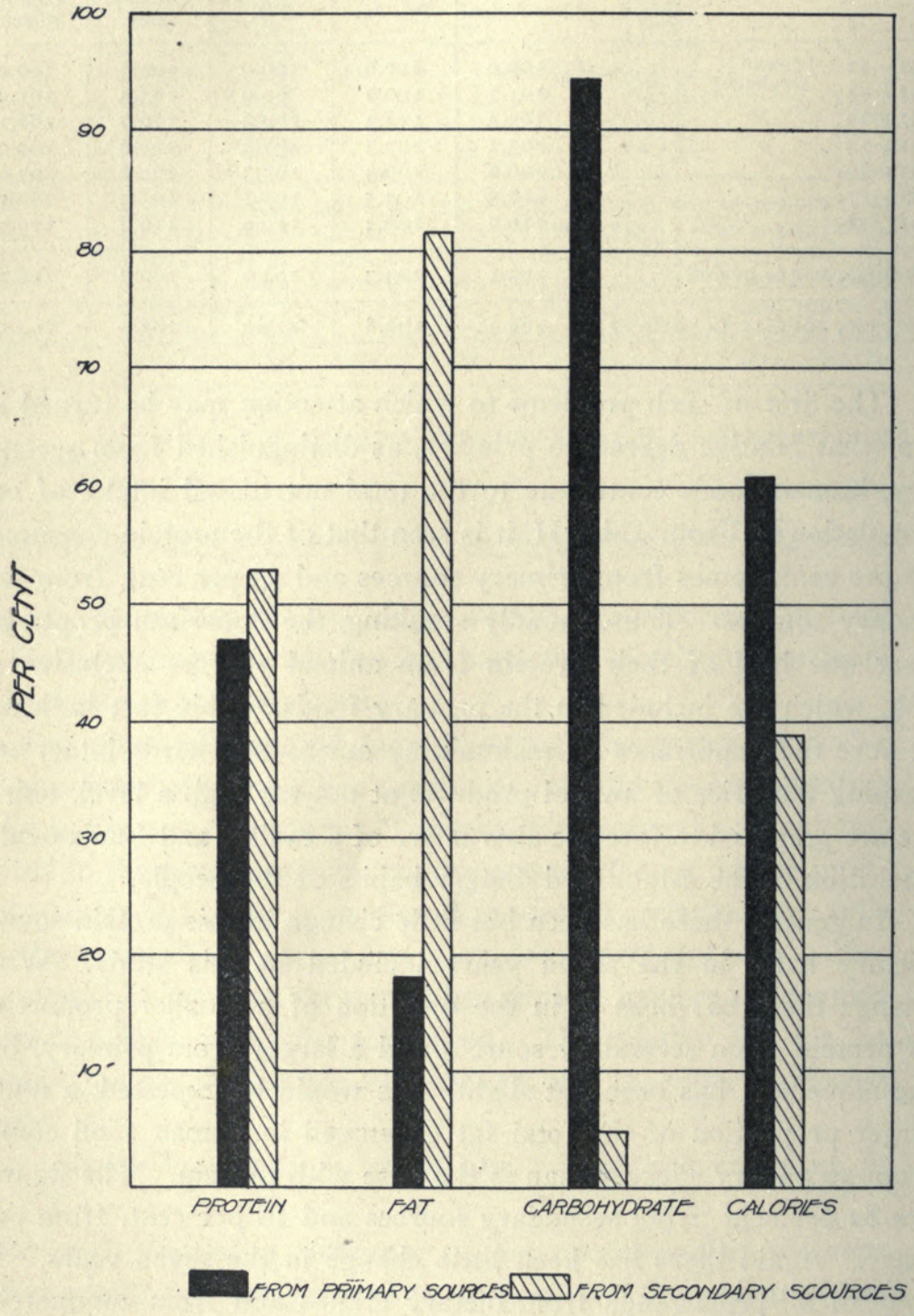

FIG. 2. Diagram showing the percentages of the total nutritional intake of the American people derived from primary and secondary sources.

ary. In the total nutritional calory intake 61 per cent. comes from primary foods and 39 per cent. from secondary.

It is interesting to compare the percentage of American nutritional intake derived from primary and secondary sources with cor-

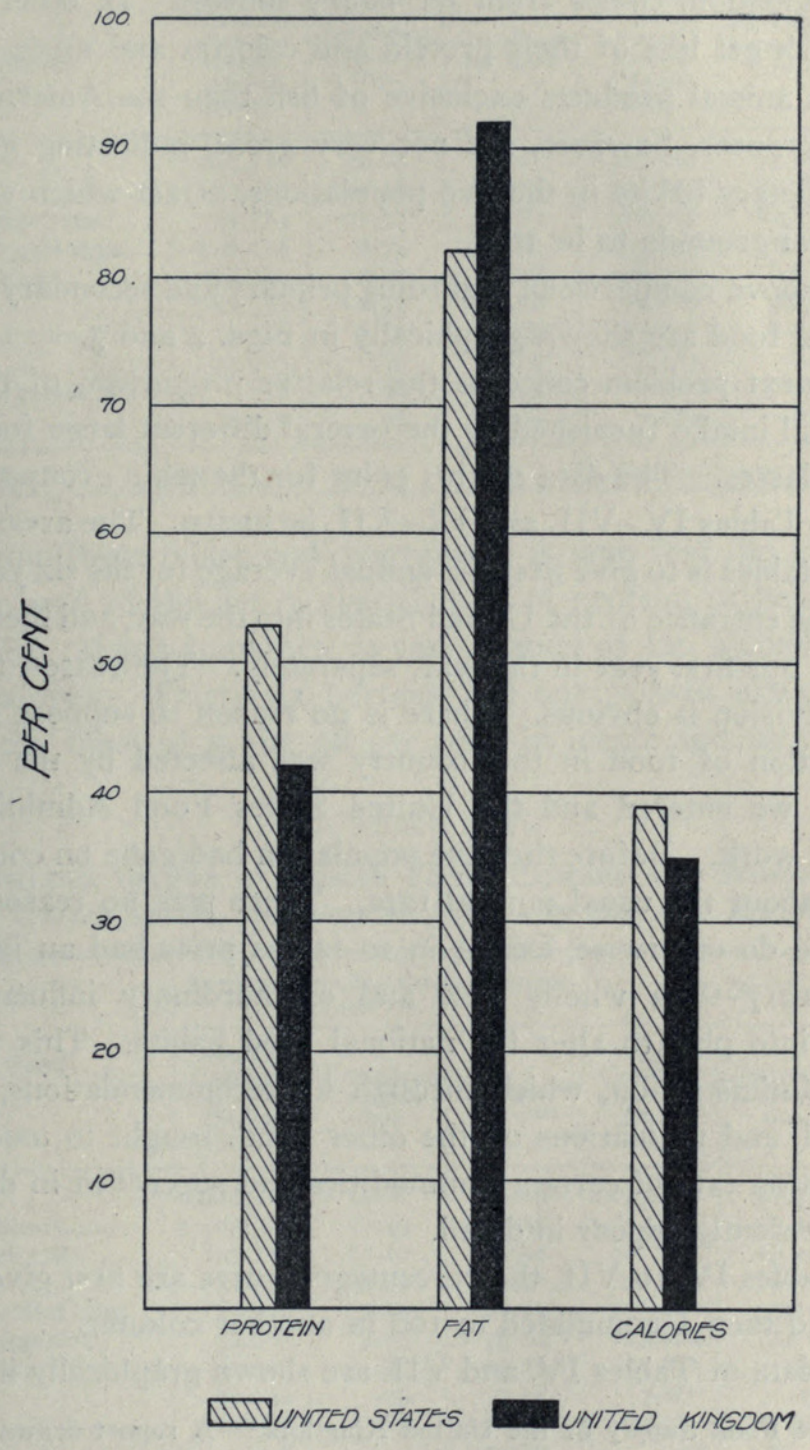

FIG. 3. Diagram showing the relative proportions of the American and British food intake derived from animal sources (exclusive of fish).

responding British figures. Calculating roughly from Table I. of the official British report[9] on the subject I find that 42 per cent. of the protein intake, 92 per cent. of the fat intake, and 35 per cent. of the energy value of the total nourishment of the population of the United Kingdom comes from *secondary* sources. In other words, the British get less of their protein and calories and more of their fat from animal products exclusive of fish than the Americans do. The differences, however, are not very great, indicating generally similar dietary habits in the two populations, a fact which we know on general grounds to be true.

The above comparisons regarding primary and secondary sources of human food are shown graphically in Figs. 2 and 3.

The next problem concerns the relative proportion of the total nutritional intake furnished by the several different large food commodity classes. The data on this point for the main groups are collected in Tables IV.–VII. and IX.–XII. inclusive. The arrangement of these tables is to give first the annual average for the six years preceding the entrance of the United States into the war, and then to give 1917–18, our first year in the war, separately. The reason for such a time division is obvious. There is no reason to suppose that the consumption of food in this country was affected by the war till the time we entered and the United States Food Administration began its work. Before then the population had gone on consuming food at about the usual normal rate. There was no reason or incentive to do otherwise, except in so far as price had an influence. But in 1917–18 a wholly new and extraordinary influence was brought into play to alter the national food habits. This was the Food Administration, which through its recommendations, on the one hand, and regulations on the other hand, sought to modify the consumption rate of certain commodities and succeeded in doing so, as will presently appear in detail.

In Tables IV. to VII. the percentage figures are first given separately and then accumulated to 100 in another column.

The data of Tables IV. and VII. are shown graphically in Fig. 4.

[9] "The Food Supply of the United Kingdom." A report drawn up by a Committee of the Royal Society at the request of the Board of Trade. London (Cd. 8421), 1917, pp. 35.

TABLE IV.

CONSUMPTION OF PROTEIN IN HUMAN FOODS, PRIMARY AND SECONDARY, IN THE UNITED STATES, ARRANGED BY GROUPS IN ORDER OF MAGNITUDE.

Group.	Average for the Six Years, 1911–12 to 1916–17.			For 1917–18.		
	Absolute Consumption of Protein (Metric Tons).	Percentage Consumption.	Cumulated Per Cent.	Absolute Consumption of Protein (Metric Tons).	Percentage Consumption.	Cumulated Per Cent.
Grains	1,316,140	36.01	36.01	1,303,348	34.44	34.44
Meats	964,117	26.38	62.39	945,277	24.98	59.42
Dairy products	744,784	20.38	82.77	788,969	20.85	80.27
Poultry and eggs	246,178	6.74	89.51	285,413	7.54	87.81
Vegetables	214,404	5.87	95.38	248,772	6.57	94.38
Fish	84,852	2.32	97.70	102,022	2.69	97.07
Oils and nuts	57,839	1.58	99.28	85,021	2.25	99.32
Fruits	24,965	.69	99.97	23,621	.62	99.94
Oleomargarine	838	.02	99.99	1,808	.05	99.99
Sugars	455	.01	100.00	439	.01	100.00
Total	3,654,572	100.00	—	3,784,690	100.00	—

From these tables and diagrams it is seen that the grains stand at the head of the list in contribution of protein, carbohydrate and calories. Meats come first in contribution of fat, second in protein and calories. Thirty-six per cent. of our protein intake normally is in the form of grain, 26 per cent. in meats and 20 per cent. in

TABLE V.

CONSUMPTION OF FAT IN HUMAN FOODS, PRIMARY AND SECONDARY, IN THE UNITED STATES, ARRANGED BY GROUPS IN ORDER OF MAGNITUDE.

Group.	Average for the Six Years, 1911–12 to 1916–17.			For 1917–18.		
	Absolute Consumption of Fat (Metric Tons).	Percentage Consumption.	Cumulated Per Cent.	Absolute Consumption of Fat (Metric Tons).	Percentage Consumption.	Cumulated Per Cent.
Meats	2,591,613	50.66	50.66	2,602,187	47.48	47.48
Dairy products	1,405,918	27.49	78.15	1,505,129	27.46	74.94
Oils and nuts	623,385	12.19	90.34	781,461	14.26	89.20
Grains	203,585	3.98	94.32	227,807	4.16	93.36
Poultry and eggs	173,349	3.39	97.71	175,220	3.20	96.56
Oleomargarine	57,965	1.13	98.84	125,024	2.28	98.84
Vegetables	21,126	.41	99.25	27,864	.51	99.35
Fruits	20,242	.49	99.65	17,866	.33	99.68
Fish	18,096	.35	100.00	17,381	.32	100.00
Sugars	0	0	100.00	0	0	100.00
Total	5,115,279	100.00	—	5,479,939	100.00	—

TABLE VI.

CONSUMPTION OF CARBOHYDRATES IN HUMAN FOODS, PRIMARY AND SECONDARY, IN THE UNITED STATES, ARRANGED BY GROUPS IN ORDER OF MAGNITUDE.

Group.	For the Six Years, 1911–12 to 1916–17.			For 1917–18.		
	Absolute Consumption of Carbohydrate (Metric Tons).	Percentage Consumption.	Cumulated Per Cent.	Absolute Consumption of Carbohydrate (Metric Tons).	Percentage Consumption.	Cumulated Per Cent.
Grains	9,208,939	56.1073	56.1073	9,291,445	54.2224	54.2224
Sugars	4,193,095	25.5473	81.6546	4,374,194	25.5266	79.7490
Vegetables	1,421,851	8.6629	90.3175	1,844,682	10.7651	90.5141
Dairy products	899,691	5.4815	95.7990	917,169	5.3524	95.8665
Fruits	627,487	3.8231	99.6221	601,350	3.5093	99.3758
Oils and nuts	57,097	.3479	99.9700	102,231	.5966	99.9724
Meats	4,907	.0299	99.9999	4,717	.0275	99.9999
Fish	20	.0001	100.0000	25	.0001	100.0000
Poultry and eggs	0	0	100.0000	0	0	100.0000
Oleomargarine	0	0	100.000 0	0	0	100.0000
Total	16,413,087	100.0000	—	17,135,813	100.0000	—

dairy products. These three great commodity groups together make up nearly 83 per cent. of our total protein intake.

The total consumption of human food was higher in 1917–18 than the average of the preceding six years. This is to be expected from the greater prosperity of the people incident to high wages,

TABLE VII.

CONSUMPTION OF HUMAN FOODS, PRIMARY AND SECONDARY, IN THE UNITED STATES, IN TERMS OF CALORIC VALUE, ARRANGED BY GROUPS IN ORDER OF MAGNITUDE.

Group.	For the Six Years, 1911–12 to 1916–17.			For 1917–18.		
	Absolute Consumption (Million Calories).	Percentage Consumption.	Cumulated Per Cent.	Absolute Consumption (Million Calories).	Percentage Consumption.	Cumulated Per Cent.
Grains	45,057,265	34.68	34.68	45,569,323	33.31	33.31
Meats	28,104,069	21.63	56.31	28,122,722	20.55+	53.86
Dairy products	19,834,010	15.26	71.57	21,010,397	15.36	69.22
Sugars	17,196,595	13.24	84.81	17,939,129	13.11	82.33
Vegetables	6,910,026	5.32	90.13	8,999,132	6.58	88.91
Oil and nuts	6,269,270	4.82	94.95	8,104,157	5.92	94.83
Fruits	2,862,540	2.20	97.15	2,722,604	1.99	96.82
Poultry and eggs	2,620,311	2.02	99.17	2,648,262	1.93	98.75
Oleomargarine	542,719	.42	99.59	1,170,593	.86−	99.61
Fish	534,509	.41	100.00	533,419	.39	100.00
Total	129,931,314	100.00	—	136,819,738	100.00	—

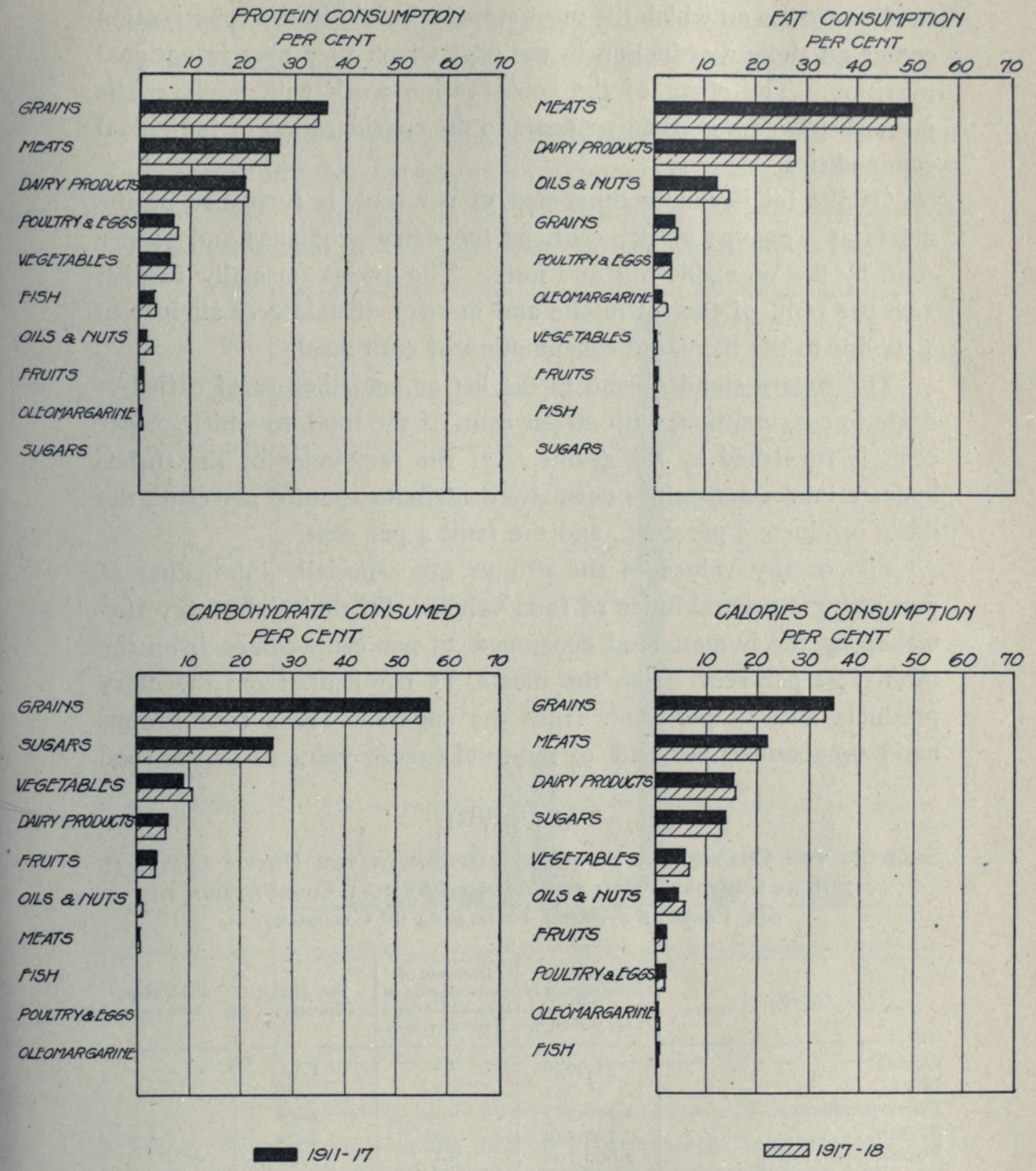

FIG. 4. Showing the percentage contribution of the different great food commodity groups to the nutritional intake of the United States, for (*a*) six years before our entry into the war, and (*b*) 1917–18.

etc. But the proportion of the total contributed by the grains and meats is smaller in 1917–18. In other words, the two great com-

modity groups on which the most stress was laid in the conservation campaign show a reduction in the part which they play in national nutrition. The effect of the conservation work will, however, be more clearly shown when we come to the consideration of individual commodities.

Of the fat normally consumed 51 per cent. is furnished by the meats as a group; 27 per cent. by the dairy products; and 12 per cent. by the vegetable oils and nuts. The grains normally furnish 3.98 per cent. of the fat intake and in 1917–18 this rose slightly to 4.16, due to the increased consumption of corn meal.

The sugars stand second in the list as contributors of carbohydrate to consumption, with 26 per cent. of the total, to which 56 per cent. is furnished by the grains. Of the remainder of the carbohydrate intake vegetables normally contribute about 9 per cent., the dairy products 5 per cent., and the fruit 4 per cent.

The energy values of the groups are especially interesting as furnishing a general index of food values. Of the total energy furnished by the human food consumed 35 per cent. comes from the grains, 22 per cent. from the meats, 15 per cent. from the dairy products and 13 per cent. from the sugars. These four groups make up about 85 per cent. of the total energy value of all the food

TABLE VIII.

SHOWING THE CHANGES IN FOOD CONSUMPTION IN THE UNITED STATES IN 1917–18 AS COMPARED WITH THE AVERAGE ANNUAL CONSUMPTION IN SIX PRECEDING YEARS (MILLIONS OF CALORIES).

Group.	Increase of Consumption in 1917–18 Over 6 Year Average.	Decrease of Consumption in 1917–18 Under 6 Year Average.	Percentage Increase.	Percentage Decrease.
Grains	512,058	—	1.14	—
Meats	18,653	—	.07	—
Dairy products	1,176,387	—	5.93	—
Sugars	742,534	—	4.32	—
Vegetables	2,089,106	—	30.23	—
Oils and nuts	1,834,887	—	29.37	—
Fruits	—	139,936	—	4.89
Poultry and eggs	27,951	—	1.07	—
Oleomargarine	627,874	—	115.69	—
Fish	—	1,090	—	.20
Total	6,888,424	—	5.30	—
Population	5,662,979	—	5.73	—

consumed. Vegetables contribute only about 5 per cent., fruit and poultry about 2 per cent. each, and vegetable oils and nuts nearly 5 per cent.

On the basis of Table VII. it is of interest to examine somewhat more carefully the changes in consumption rate in 1917–18 as compared with the average of the six preceding years. Such a comparison is made in Table VIII. and shown graphically in Fig. 5.

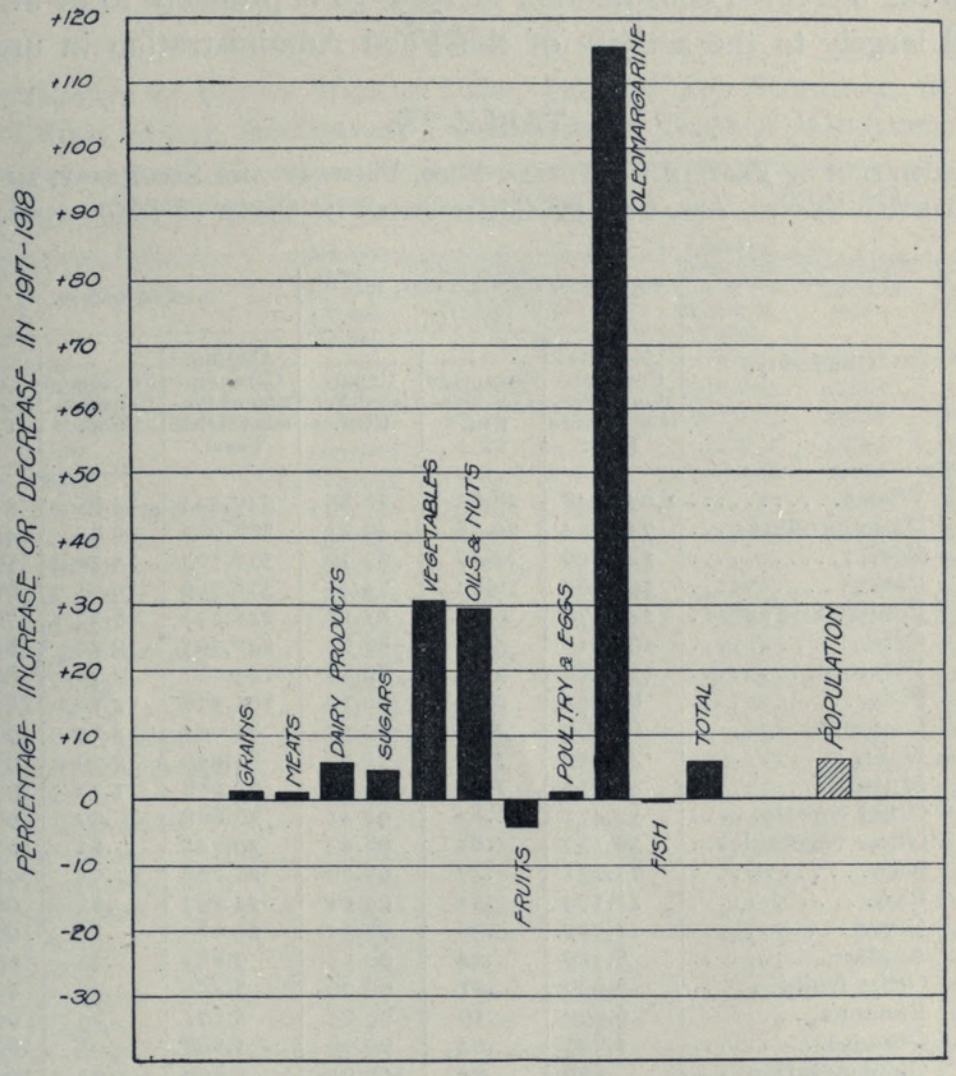

FIG. 5. Diagram showing the increase or decrease in food consumption in 1917–18 as compared with the average of the preceding six years.

From Table VIII. and the diagram it is observed that the total increase in human food consumption in 1917–18 was less (nearly ½ per cent.) proportionately than in the increase in population, both being compared with the average of the six preceding years. The

consumption of meats practically did not increase at all, and the consumption of grains only about 1 per cent.

The great increases were first in the consumption of vegetables and oils and nuts, amounting to 30 per cent. in the one case and 29 per cent. in the other, and second in oleomargarine where the consumption increased nearly 116 per cent. in 1917–18 over the average of the preceding six years. In the case of vegetables and oils and nuts the increased consumption in 1917–18 is probably to be attributed largely to the activity of the Food Administration in urging

TABLE IX.

CONSUMPTION OF PROTEIN IN HUMAN FOOD, PRIMARY AND SECONDARY, IN THE UNITED STATES, ARRANGED BY COMMODITIES IN ORDER OF MAGNITUDE.

Order No.	Commodity.	Average for the Six Years, 1911–12 to 1916–17.			For 1917–18.		
		Absolute Consumption of Protein (Metric Tons.	Percentage Consumption.	Cumulated Per Cent.	Absolute Consumption of Protein (Metric Tons).	Percentage Consumption.	Cumulated Per Cent.
1	Wheat	1,054,548	28.85	28.85	940,543	24.85	24.85
2	Dairy products	744,784	20.38	49.23	788,969	20.85	45.70
3	Beef	528,709	14.47	63.70	539,703	14.26	59.96
4	Pork	392,665	10.74	74.44	378,799	10.01	69.97
5	Poultry and eggs	246,178	6.74	81.18	248,772	6.57	76.54
6	Corn	202,717	5.55	86.73	242,395	6.40	82.94
7	Potatoes	114,598	3.14	89.87	143,167	3.78	86.72
8	Fish	84,852	2.32	92.19	105.578	2.79	89.51
9	Legumes	69,669	1.91	94.10	85,021	2.25	91.76
10	Nuts	46,819	1.28	95.38	81,939	2.16	93.92
11	Mutton	43,712	1.20	96.58	65,088	1.72	95.64
12	Other cereals	30,471	.83	97.41	36,668	.97	96.61
13	Other vegetables	30,137	.82	98.23	30,725	.81	97.42
14	Rice	17,231	.47	98.70	28,298	.75	98.17
15	Rye	11,174	.31	99.01	24.597	.65	98.82
16	Cocoa	11,020	.30	99.31	20.083	.53	99.35
17	Apples	8,719	.24	99.55	9,283	.25	99.60
18	Other fruits	7,620	.21	99.76	7,458	.20	99.80
19	Bananas	6,979	.19	99.95	5.771	.15	99.95
20	Oranges	1,647	.04	99.99	1,808	.05	100.00
21	Oleomargarine	838	.02	100.01	1,109	.03	100.03
22	Sugars	455	.01	100.02	439	.01	100.04
—	Oils	0	0	100.02	0	0	100.04
	Total	3,654,572	—	—	3,784,690	—	—

the consumption of these commodities to afford a relief of the pressure on wheat and meat products. In the case of oleomargarine the increased consumption is clearly due entirely to a favorable

price differential as compared with butter and lard, taking into account palatability.

The only two great commodity groups showing decreases in consumption in 1917–18 are fruits and fish. In both cases the result is probably to be explained by price influences, taken together with palatability and popular ideas as to relative necessity in the diet. For example the price of meat may rise relatively much more than that of fruits or fish without leading to any reduction in consump-

TABLE X.

CONSUMPTION OF FAT IN HUMAN FOODS, PRIMARY AND SECONDARY, IN THE UNITED STATES, ARRANGED BY COMMODITIES IN ORDER OF MAGNITUDE.

Order No.	Average for the Six Years 1911–12 to 1916–17.				For 1917–18.		
	Commodity.	Absolute Consumption of Fat (Metric Tons).	Percentage Consumption.	Cumulated Per Cent.	Absolute Consumption of Fat (Metric Tons).	Percentage Consumption.	Cumulated Per Cent.
1	Pork	2,024,236	39.57	39.57	2,045,653	37.33	37.33
2	Dairy products	1,405,918	27.49	67.06	1,505,129	27.46	64.79
3	Oils	505,201	9.88	76.94	554,851	10.13	74.92
4	Beef	505,033	9.87	86.81	513,596	9.37	84.29
5	Poultry and eggs	173,349	3.39	90.20	179,337	3.27	87.56
6	Corn	97,355	1.90	92.10	175,220	3.20	90.76
7	Nuts	92,348	1.81	93.91	125,024	2.28	93.04
8	Wheat	91,929	1.80	95.71	118,845	2.17	95.21
9	Mutton	65,499	1.28	96.99	81,835	1.49	96.70
10	Oleomargarine	57,965	1.13	98.12	47,273	.86	97.56
11	Cocoa	25,836	.51	98.63	46,853	.86	98.42
12	Fish	18,096	.35	98.98	23,104	.42	98.84
13	Other cereals	12,391	.24	99.22	17,866	.33	99.17
14	Other vegetables	9,935	.19	99.41	12,586	.23	99.40
15	Apples	8,629	.17	99.58	7,953	.15	99.55
16	Other fruits	7,713	.15	99.73	7,451	.14	99.69
17	Potatoes	6,366	.12	99.85	7,325	.13	99.82
18	Legumes	4,824	.09	99.94	6,767	.12	99.94
19	Bananas	3,488	.07	100.01	3,256	.06	100.00
20	Rye	1,479	.03	100.04	2,885	.05	100.05
21	Rice	431	.01	100.05	767	.01	100.06
22	Oranges	411	.01	100.06	278	.01	100.07
—	Sugars	0	0	100.06	0	0	100.07
	Total	5,115,279	—	—	5,479,939	—	—

tion, owing to the general belief that meat is a more necessary article of diet than the other two sorts of food mentioned.

We may next consider the gross consumption of individual commodities on the same plan that has just been used in handling the groups. The data are given in Tables IX. to XII. inclusive. In

these tables it will be noted that the cumulated percentage columns run to more than 100 per cent. by trifling amounts. This is to take care of the item "other meat products" which appears in the net export table but not in production (in basic tables not here given). In the main consumption table it is carried into the subtotal "Meats," but does not appear as a separate item, because of the impossibility of calculating it as such.

TABLE XI.

CONSUMPTION OF CARBOHYDRATE IN HUMAN FOODS, PRIMARY AND SECONDARY, IN THE UNITED STATES, ARRANGED BY COMMODITIES IN ORDER OF MAGNITUDE.

Order No.	Commodity.	Average for the Six Years, 1911–12 to 1916–17.			For 1917–18.		
		Absolute Consumption of Carbohydrate (Metric Tons).	Percentage Consumption.	Cumulated Per Cent.	Absolute Consumption of Carbohydrate (Metric Tons).	Percentage Consumption.	Cumulated Per Cent.
1	Wheat	6,944,794	42.3125	42.3125	6,195,182	36.1534	36.1534
2	Sugars	4,193,095	25.5473	67.8598	4,374,194	25.5266	61.6800
3	Corn	1,805,564	11.0008	78.8606	2,155,310	12.5778	74.2578
4	Potatoes	935,881	5.7020	84.5626	1,169,204	6.8232	81.0810
5	Dairy products.	899,691	5.4815	90.0441	917,169	5.3524	86.4334
6	Apples	312,589	1.9045	91.9486	398,275	2.3242	88.7576
7	Other vegetables	303,868	1.8514	93.8000	352,857	2.0592	90.8168
8	Legumes	182,103	1.1095	94.9095	303,428	1.7707	92.5875
9	Other fruits	171,574	1.0454	95.9549	284,668	1.6612	94.2487
10	Rice	170,151	1.0367	96.9916	277,203	1.6177	95.8664
11	Other cereals	159,113	.9694	97.9610	268,425	1.5665	97.4329
12	Rye	129,318	.7879	98.7489	219,237	1.2794	98.7123
13	Bananas	111,628	.6801	99.4290	92,328	.5388	99.2511
14	Nuts	35,571	.2167	99.6457	63,054	.3680	99.6191
15	Oranges	31,696	.1931	99.8388	39,177	.2286	99.8477
16	Cocoa	21,526	.1312	99.9700	21,360	.1247	99.9724
17	Pork	2,740	.0167	99.9867	2,859	.0167	99.9891
18	Beef	1,707	.0104	99.9971	1,577	.0092	99.9983
19	Mutton	484	.0029	100.0000	315	.0018	100.0001
20	Fish	20	.0001	100.0001	25	.0001	100.0002
—	Oils	0	0	100.0001	0	0	100.0002
—	Poultry and eggs	0	0	100.0001	0	0	100.0002
—	Oleomargarine	0	0	100.0001	0	0	100.0002
	Total	16,413,087			17,135,813		

The data of Tables IX. to XII. inclusive are shown, exhibited graphically, in Figs. 6 to 9.

Taking first the protein consumption, as given in Table IX., we see that wheat stands at the head of the list as a source of protein for the population of this country, contributing nearly 28 per cent.

TABLE XII.

CONSUMPTION OF HUMAN FOODS, PRIMARY AND SECONDARY, IN THE UNITED STATES, IN TERMS OF CALORIC VALUE, ARRANGED BY COMMODITIES IN ORDER OF MAGNITUDE.

Order No.	Commodity.	Average for the Six Years, 1911–12 to 1916–17.			For 1917–18.		
		Absolute Consumption (Million Calories).	Percentage Consumption.	Cumulated Per Cent.	Absolute Consumption (Million Calories.	Percentage Consumption.	Cumulated Per Cent.
1	Wheat.....	33,657,299	25.90	25.90	30,021,979	21.94	21.94
2	Pork.....	20,453,649	15.74	41.64	21,010,397	15.36	37.30
3	Dairy products.	19,834,010	15.26	56.90	20,594,616	15.05	52.35
4	Sugars.....	17,196,595	13.24	70.14	17,939,129	13.11	65.46
5	Corn.....	9,141,678	7.03	77.17	10,938,521	7.99	73.45
6	Beef.....	6,892,851	5.30	82.47	7,017,398	5.13	78.58
7	Oils.....	4,700,590	3.62	86.09	5,455,418	3.99	82.57
8	Potatoes.....	4,366,750	3.36	89.45	5,162,528	3.77	86.34
9	Poultry and eggs	2,620,311	2.02	91.47	2,648,262	1.94	88.28
10	Other vegetables	1,465,344	1.13	92.60	2,262,988	1.65	89.93
11	Apples.....	1,403,750	1.08	93.68	1,927,964	1.41	91.34
12	Nuts.....	1,196,911	.92	94.60	1,904,998	1.39	92.73
13	Legumes.....	1,077,932	.83	95.43	1,638,716	1.20	93.93
14	Other cereals...	893,383	.69	96.12	1,381,039	1.01	94.94
15	Other fruits....	800,831	.62	96.74	1,299,820	.95	95.89
16	Mutton.....	791,032	.61	97.35	1,205,454	.88	96.77
17	Rice.....	774,430	.60	97.95	1,170,593	.86	97.63
18	Rye.....	590,475	.45	98.40	994,221	.73	98.36
19	Oleomargarine .	542,719	.42	98.82	678,641	.50	98.86
20	Fish.....	534,509	.41	99.23	553.498	.40	99.26
21	Bananas.....	519,109	.40	99.63	533,419	.39	99.65
22	Cocoa.....	371,769	.29	99.92	429,360	.31	99.96
23	Oranges.....	138,850	.11	100.03	93,569	.07	100.03
	Total.....	129,931,314			136,819,738		

normally to the total. Dairy products are second with 20 per cent. of the total. Beef with 14 per cent. and pork with 11 per cent. stand next. The other commodities contributing more than 2 per cent. to the total protein intake of the population are, in the order named: Poultry and eggs, corn, potatoes, and fish. Taken together, these eight commodities furnish 92 per cent. of the total protein intake. We see that a very few commodities furnish a very large percentage of the nutritional intake. This fact, in and of itself, helps enormously towards the possibility of making a study such as this substantially accurate in its results. It is clear that the minor items omitted from our calculations have no significance in the final general result. If four food commodities furnish nearly 75 per cent. of the total protein ingested, it is obvious that a large error,

or even the entire omission, of single ones of the other minor items can have but little effect.

Comparing the order of the commodities in 1917–18 with the average of the six preceding years, it is seen that the only change of position among the eight commodities normally furnishing over

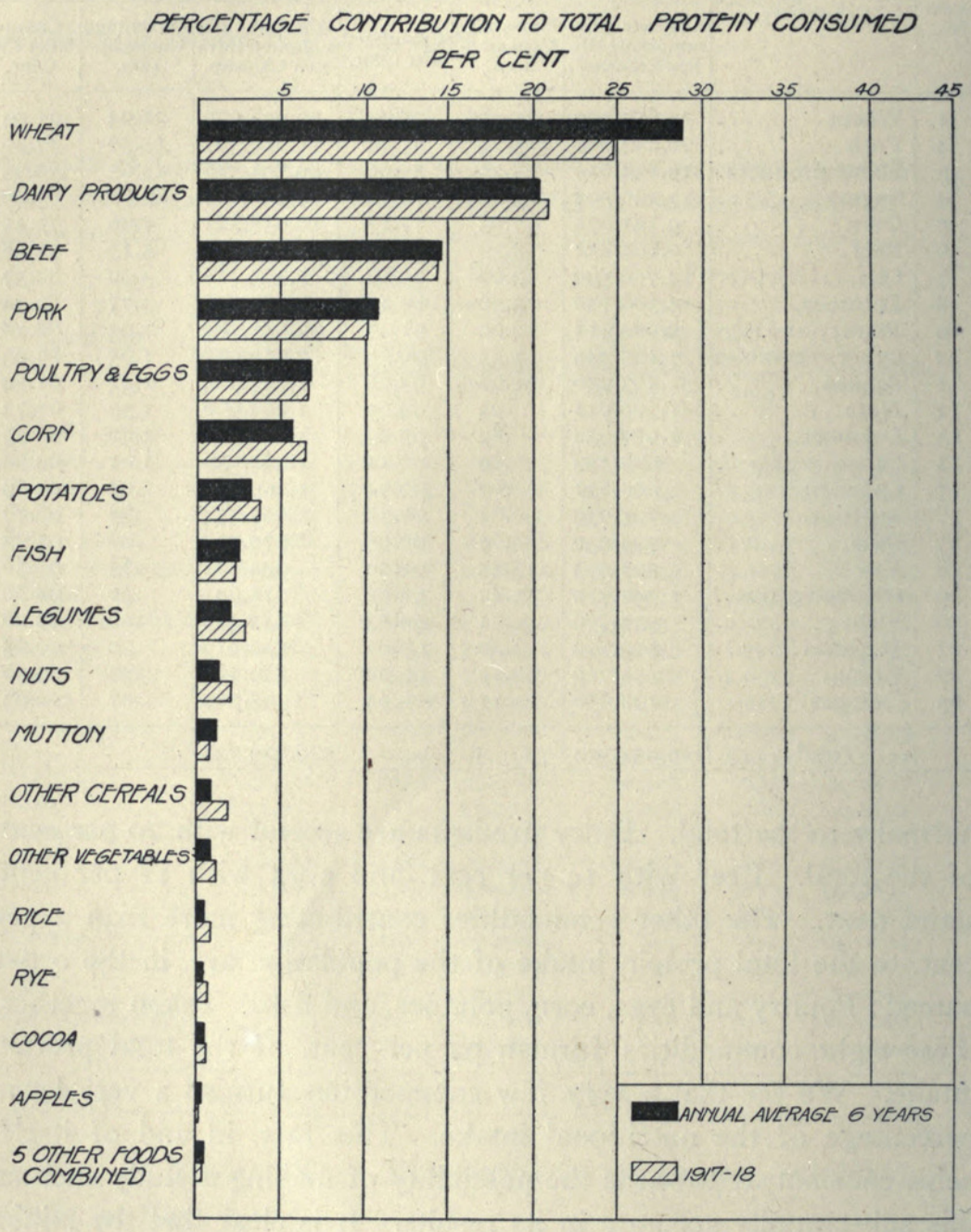

FIG. 6. Diagram showing the percentage of the total protein consumed in the United States contributed by each of 23 commodities. The solid bars denote the average consumption in the six years preceding our entry into the war. The cross-hatched bars denote the consumption in 1917 and 1918.

90 per cent. of the protein is in respect of the last one on the list, namely, fish. In 1917–18 the legumes (beans and peas) moved up to the eighth place and fish moved to the ninth place.

Turning to the fat consumption, it is seen that approximately 40 per cent. of the total fat in the nutritional intake of this country

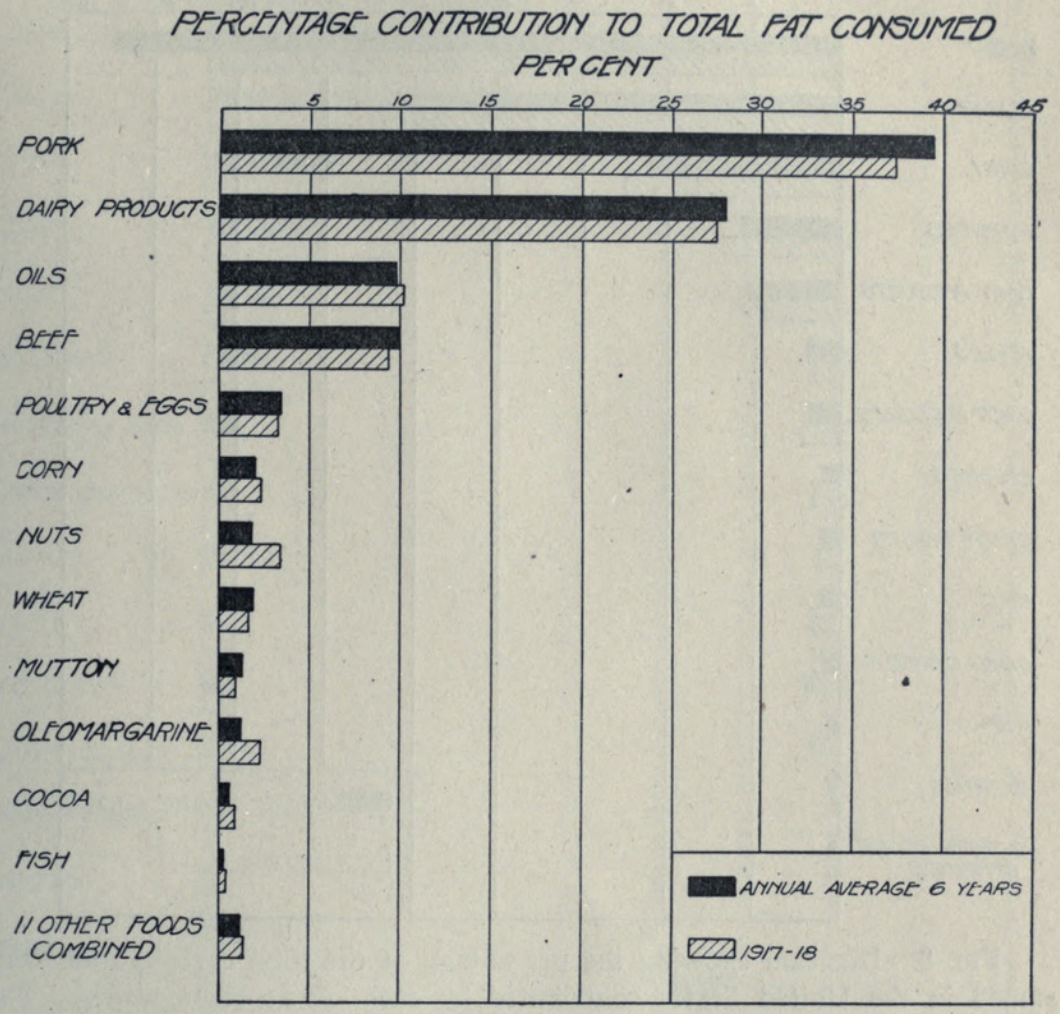

FIG. 7. Diagram showing the percentage of the total fat consumed in the United States contributed by each of 23 commodities. The solid bars denote the average consumption in the six years preceding our entry into the war. The cross-hatched bars denote consumption in 1917 and 1918.

comes from pork and its products. The hog is in a class by itself as a source of fat for human nutrition, with the population of this country. Dairy products stand second in the list, with approximately 27½ per cent. of the total. After the dairy products there is a considerable drop in percentage contribution as we pass to the next item on the list, namely, the vegetable oils, which normally

furnish only about 10 per cent. of the fat intake. Beef contributes almost exactly the same percentage. The four commodities named together furnish nearly 87 per cent. of the total fat intake. Only

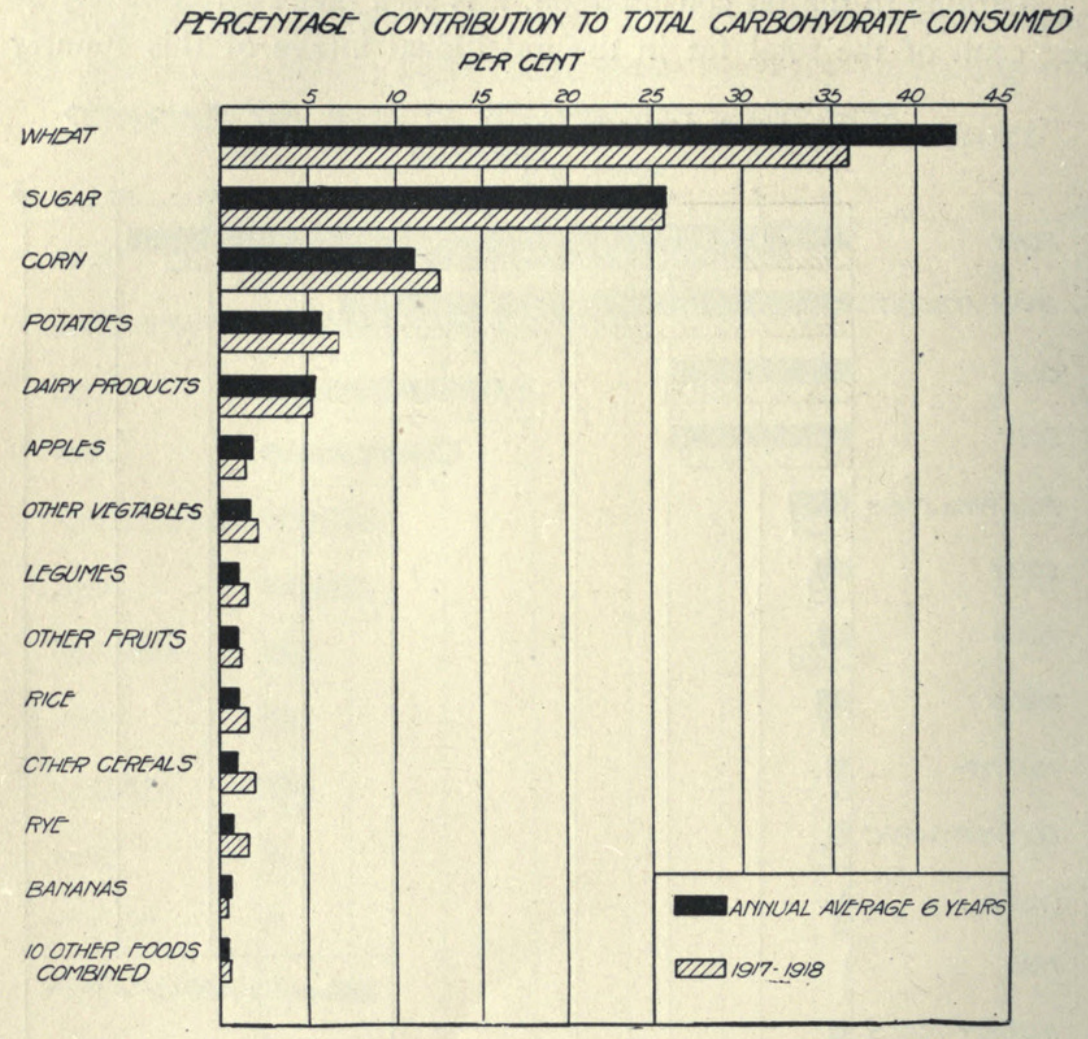

FIG. 8. Diagram showing the percentage of the total carbohydrate consumed in the United States contributed by each of 23 commodities. The solid bars denote the average consumption in the six years preceding our entry into the war. The cross-hatched bars denote the consumption in 1917 and 1918.

one other commodity group—namely, poultry and eggs—furnishes more than 2 per cent. normally.

In 1917–18 there are some changes of significance in the relative position of the commodities as fat contributors. The first four items, pork, dairy products, oils and beef, stand in the same order in 1917–18 as in the six years preceding. Nuts moved up in 1917–18 to the fifth place from the seventh, which they had occupied

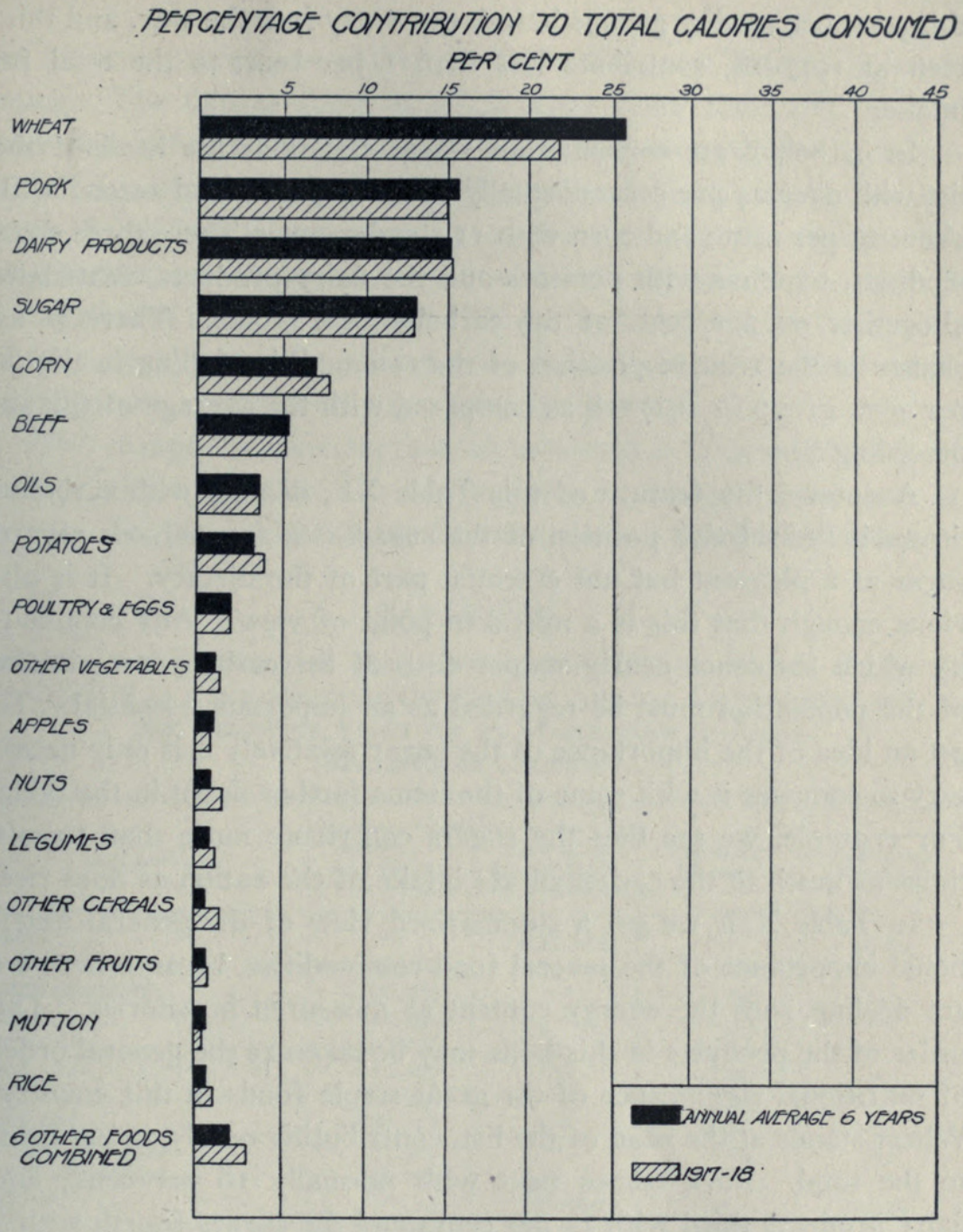

FIG. 9. Diagram showing the percentage of the total energy value of the food consumed in the United States contributed by each of 23 commodities. The solid bars denote the average consumption in the six years preceding our entry into the war. The cross-hatched bars denote the consumption in 1917 and 1918.

before. Oleomargarine moved from the tenth place to the seventh. Corn, in spite of the increased consumption in 1917, dropped from the sixth place to the eighth in percentage contribution. Twelve of

the great commodity groups before our entry into the war, and thirteen in 1917–18, contribute less than 1 per cent. to the total fat intake.

In carbohydrate consumption wheat stands at the head of the list with over 24 per cent. normally. The sugars stand second with about 26 per cent., and corn with 11 stands next. These three commodities, together with potatoes and the dairy products, contribute altogether 90 per cent. of the carbohydrate intake. There is no change in the relative position of the commodities falling in the 90 per cent. group in 1917–18 as compared with the average of the six preceding years.

A noteworthy feature of this Table XI., dealing with carbohydrates is the relative position of the sugars. Many persons regard sugar as a pleasant but not essential part of the dietary. It is obvious enough that this is a mistaken point of view. Any commodity which furnishes nearly 26 per cent. of the carbohydrate intake of the population must be regarded as an important essential. To get an idea of the importance of the sugar relatively it is only necessary to compare it with some of the items farther down in the table. For example, we see that the sugars contribute more than twenty times as much to the carbohydrate intake of the nation as does rice.

In Table XII. we get a summarized view of the general nutritional importance of the several food commodities, because here we are dealing with the energy content as measured in calories. The order of the products in this table may be taken as the general order of nutritional significance of the great staple foods in this country. Wheat stands at the head of the list, contributing nearly 26 per cent. to the total. Pork comes next with normally 16 per cent., and dairy products third with 15 per cent., and the sugars fourth with 7 per cent. Then follow corn, beef, the vegetable oils, potatoes, poultry and eggs. These nine commodity groups together make up over 91 per cent. of the total nutritional intake of the population. The smallest contribution to the total nutrition is made by oranges, furnishing about $\frac{1}{10}$ of 1 per cent. to the total. Bananas and fish furnish only about $\frac{4}{10}$ of 1 per cent. of the total, and rye and rice only a little more.

The changes in 1917–18, as compared with the average in the

six preceding years, as shown in Table XII., are extremely interesting. The figures show in much more detail than any that we have had hitherto the precise effects of the conservation and substitution campaign of the United States Food Administration during 1917–18. While wheat normally contributes 25.9 per cent. of the total nutritional intake (as measured by energy value), in 1917–18 it contributed but 21.9 per cent. To go farther down the table, rice, which normally contributed but 0.6 of 1 per cent. to the total nutritional intake, contributed 1 per cent. in 1917–18.

The changes in consumption, as indicated in Table XII., are of such great interest that it is worth while to examine them more in detail. To this end a table on the same plan as Table VII. is shown.

TABLE XIII.

SHOWING THE CHANGES IN FOOD CONSUMPTION IN THE UNITED STATES IN 1917–18 AS COMPARED WITH THE AVERAGE ANNUAL CONSUMPTION OF SIX PRECEDING YEARS FOR 23 STAPLE HUMAN FOODS (MILLIONS OF CALORIES).

Commodity.	Increase of Consumption in 1917–18 Over 6 Year Average.	Decrease of Consumption in 1917–18 Under 6 Year Average.	Percentage Increase.	Percentage Decrease.
Wheat	—	3,635,320	—	10.80
Pork	140,967	—	.69	—
Dairy products	1,176,387	—	5.93	—
Sugar	742,534	—	4.32	—
Corn	1,796,843	—	19.66	—
Beef	224,547	—	3.26	—
Oils	461,938	—	9.83	—
Potatoes	1,088,668	—	24.93	—
Poultry and eggs	27,951	—	1.07	—
Other vegetables	439,654	—	—	—
Apples	—	198,296	—	14.13
Nuts	1,066,077	—	89.07	—
Legumes	560,784	—	52.02	—
Other cereals	1,034,581	—	115.80	—
Other fruits	193,390	—	24.15	—
Mutton	—	237,534	—	30.03
Rice	606,609	—	78.33	—
Rye	709,345	—	120.13	—
Oleomargarine	627,874	—	115.69	—
Fish	—	1,090	—	.20
Bananas	—	89,749	—	17.29
Cocoa	306,872	—	82.54	—
Oranges	—	45,281	—	32.61
Total net increase	6,888,424	—	5.30	—
Population	5,662,979	—	5.73	—

The data of Table XIII. are exhibited graphically in Fig. 10. In this diagram the total length of the bars from the *O* line shows the total percentage increase or decrease in consumption in 1917–18 as compared with the preceding six years. The cross-hatched portion of each bar shows the percentage increase in population, and therefore the part of the increased consumption to be expected as

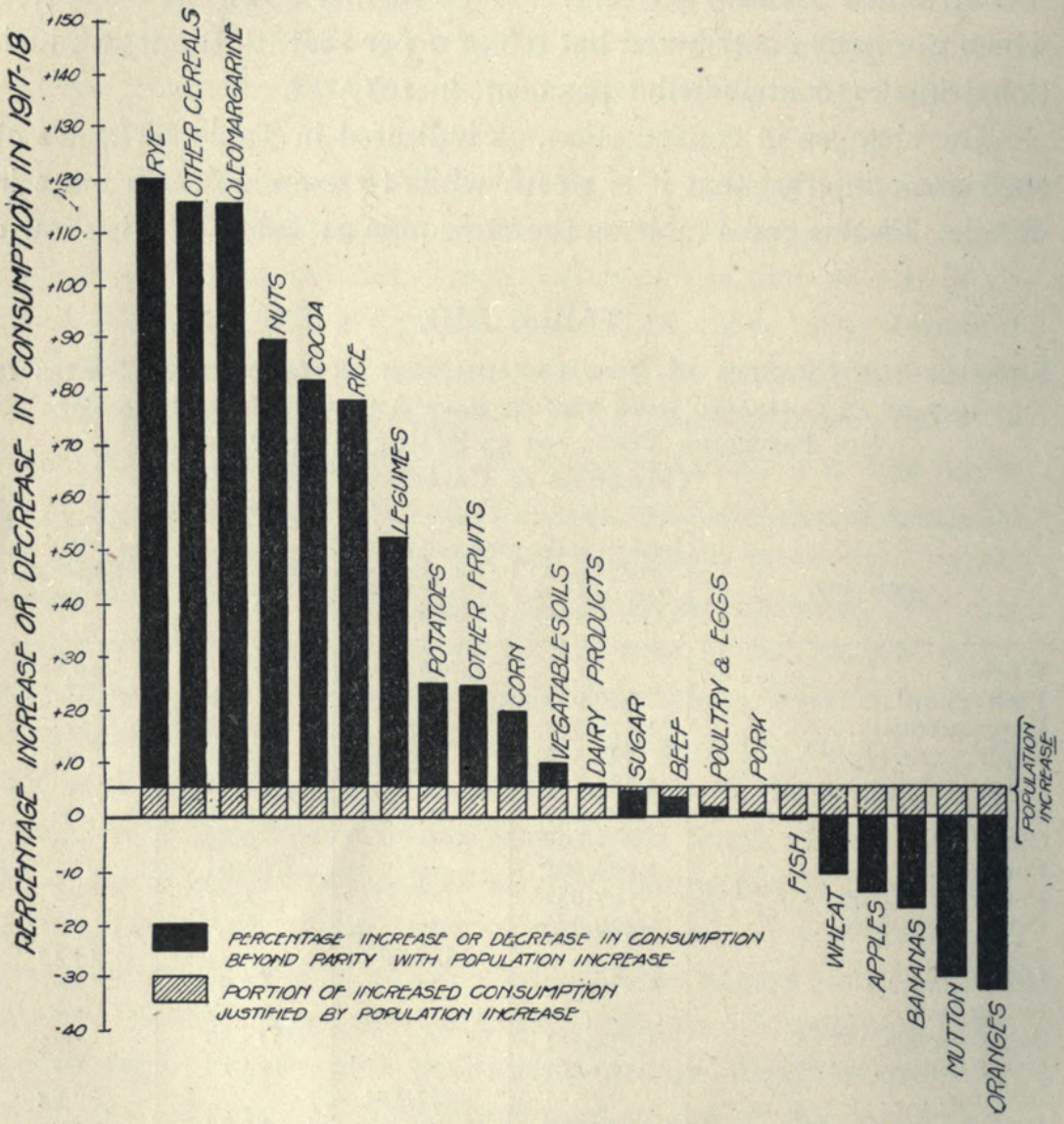

FIG. 10. Showing the percentage increase or decrease in consumption in 1917–18 as compared with the annual average of the six years preceding. For explanation see text.

a result of population increase. Where the black bar is below the top of the cross-hatched population bar it means a conservation. Thus the true conservation on wheat amounted to $10.80 + 5.73 = 16.53$ per cent. of the normal average consumption.

The table and diagram bring out very clearly the effectiveness of the Food Administration's campaign for conservation and substitution in foods. It will be noted at once that the commodities showing great increases in consumption in 1917–18 over the preceding years are, for the most part, those which the Food Administration urged to be substituted for articles of which the supply was less abundant, and for which the needs of the Allies were greater. Thus, rye, which constituted the most popular of the substitutes for wheat in the public mind, shows the greatest increased consumption in 1917–18. Next to it stands the "Other cereals" of our classification, including barley and buckwheat. Nuts, rice and the vegetables generally show increases beyond the population increase, showing that the people very generally followed the suggestions of the Food Administration to consume more of these products and save wheat. The articles on which the Food Administration most strongly urged conservation—namely, wheat, beef, mutton, pork and the sugars—all show either a consumption actually below the normal average, or else a very slight absolute increase well below the population percentage increase. In either case a real and substantial conservation is, of course, shown. The decrease in consumption of the most popular fruits, oranges, apples and bananas is largely if not entirely explained by high prices for these products.

We get now to the most interesting stage of any discussion of food, namely, the per capita per day consumption. Calculating the results on this basis puts them in a form where we may form a better judgment of their meaning and compare them with accepted dietary standards. In this connection it is to be remembered that hitherto we have had no careful studies on a per capita basis of the actual nutritional intake of the population as a whole. All dietary standards are based not on the actual practice of the whole population, but rather upon dietary studies made on restricted groups of selected individuals. While a very large number of such studies have been made by the United States Department of Agriculture particularly from ten to twenty years ago, it must be obvious that since such studies are made on selected small groups they can only inferentially give any picture of what is taking place in the population as a whole. The theory of random sampling makes it clear

that any inference from dietary studies, as they have been carried on, to the whole population rests on an exceedingly dubious foundation. It will therefore be of great interest to compare the results of the present careful investigation of the population as a whole with the results of previous dietary studies.

In reducing consumption data to a per capita basis it would obviously be foolish to take the actual total population as a base, for the reason that the amount of food consumed changes with the age of the individual, particularly in early life. On account of this fact the usual practice in computations of this kind is to reduce, not to a per capita basis, but to an adult man basis. In doing this a fractional factor is used to multiply the number of individuals of certain lower ages, the magnitude of the factor being proportional to the relation which the nutritional intake of the individual at the younger age bears to that of an average adult man.

In the present study the following age-intake factors have been used:

Age in Years.	Man Value Factor.
0–5	0.50
6–13	0.77
14–18, male	1.00
14–18, female	0.83
19 on, male	1.00
19 on, female	0.83

The man factor values here used have been adopted after careful study of the subject. They differ in detail somewhat from those adopted by English physiologists in similar calculations, but in the net end result come to much the same thing.

Applying these factors to the total population of the United States, and assuming that the age distribution of the population is the same in each of the years studied, we get the population in terms of adult men as set forth in Table XIV. for the midyear point of each of the years included in this study. The population equivalents in Table XIV. are used for the base for the per capita per diem calculations which follow.

Before entering on the detailed discussion of per capita consumption figures it is well to recall a fact which is liable to escape attention, unless special attention is called to it. This is the fact

TABLE XIV.

POPULATION OF CONTINENTAL UNITED STATES IN TERMS OF ADULT MEN.

Year.	Population Equivalent in Adult Men, January 1.
1912	79,571,000
1913	80,930,000
1914	82,289,000
1915	83,648,000
1916	85,007,000
1917	86,366,000
1918	87,724,000

that the final figures in this paper, which are called "consumption figures," really include something more than consumption in a nutritional sense. They include the food actually eaten plus that which is wasted by loss in cooking, in garbage, etc. It is necessary to be entirely clear on this point. In calculating the nutrients in the intermediate calculations use has been made of factors which allowed for *inedible* refuse, so that all of the inedible portion of the foods as produced or imported have already been deducted in our calculations up to this point. Furthermore, gross losses from storage, spoilage, transportation, etc., have been deducted. Even after all these deductions have been made, however, it is obvious that there is still a considerable amount of loss and wastage of strictly edible material, which might be saved and consumed under a theoretically ideal system of preparing food for the table plus a conscientious ingestion of every bit of edible material. Of course, as a matter of fact, neither of these theoretically ideal conditions at all prevail. There is a considerable loss of nutrient values in the process of cooking as ordinarily practiced. This loss is undoubtedly greater for fats than for any other of the nutrients. It is a troublesome and time-consuming process for the housewife to conserve and utilize all of the fat which gets melted and floats about in the water in which foods are cooked, or adheres to the utensils in which they are cooked. Nor, in the minds of most people, is there any necessity or desirability of saving this fat. In fact, a great many people in this country object very strongly to what they designate as "greasy cooking." Consequently, floating fat of soup stock is skimmed off and thrown away in the vast majority of instances.

The result is that in calculations made in the way those of this study have been made, which include the total nutrient value in the edible portion of food materials, after deducting inedible waste and the losses which accrue up to the time the food reaches the consumer, there is bound to be an apparently high consumption of fats. The figures here presented are really statements of consumption plus edible waste and should be so regarded.

Another important factor is that of edible waste in garbage: that is to say, the uneaten portion of the prepared food which is edible and might be consumed, but is not for reasons of taste, overestimation of ingestive capacity, etc.

It is quite impossible to arrive at any accurate estimate of what the amount of losses of nutrients in cooking and in avoidable wastage of edible material is. On the first point it would be extremely difficult ever to gather accurate data because the practice of housewives and cooks varies so enormously in this regard. That a great deal can be accomplished in reducing the amount of edible material going into the garbage can has been demonstrated with both the civilian and the Army population of the United States during the past year.[10]

The recent study of Murlin (*loc. cit.*) gives the data regarding edible waste obtained from the nutritional surveys of the training camps. The average figure for 213 messes show that 7 per cent. of the protein supplied was wasted, 9 per cent. of the fat and 6 per cent. of the carbohydrate. Because of special conditions surrounding the investigation, however, and because of the differences of camp life, these figures are not at all applicable to civilian conditions.

Looking at the matter from the national point of view, it seems probable that of the protein in human foods left in the country for consumption in the statistical sense, it is safe to say that 5 per cent. is lost in edible wastage; of the fat left in the country for consumption as human food, it is believed that at least 25 per cent. is lost through wastage. This figure seems large, but it probably under-

[10] Pearl, R., "Statistics of Garbage Collection and Garbage Grease Recovery in American Cities," *Jour. Ind. Eng. Chem.*, Volume 10, page 927, 1918, and Murlin, J. H., "Diet of the U. S. Army Soldier in the Training Camp," *Jour. Amer. Med. Assoc.*, Vol. 71, pp. 950–951, 1918.

estimates rather than overestimates the fact. Of the carbohydrates, probably there is 20 per cent. of edible wastage.

The total statistical consumption (ingestion plus edible wastage) of human food in the United States, by years from 1911 to 1918, is shown on an "adult man" per capita basis in Table XV.

TABLE XV.

SUMMARY OF CONSUMPTION PER ADULT MAN.

Year.	Protein.		Fat.		Carbohydrate.		Calories.	
	Per Annum (Kilos).	Per Day (Grams).	Per Annum (Kilos).	Per Day (Grams).	Per Annum (Kilos).	Per Day (Grams).	Per Annum (Kilos).	Per Day (Grams).
1911–12.....	44.70	122	62.12	170	195.48	536	1,563,450	4,283
1912–13.....	44.04	121	60.44	166	198.68	544	1,558,232	4,269
1913–14.....	45.08	124	60.22	165	209.25	573	1,591,621	4,361
1914–15.....	43.05	118	63.42	174	193.42	530	1,560,326	4,275
1915–16.....	44.48	122	61.22	168	200.48	549	1,574,621	4,314
1916–17.....	43.01	118	62.45	171	189.94	520	1,536,833	4,211
1917–18.....	43.14	118	62.47	171	195.34	535	1,559,661	4,273
Average, whole period.....	43.91	120	61.78	169	197.45	541	1,565,075	4,288
Average, 1911–12 to 1916–17	44.05	121	61.65	169	197.82	542	1,566,032	4,290

Applying the estimated percentage deductions for edible wastage stated above to the per capita average for the whole period we have the following results for ingested human food:

114 grams protein per man per day,
127 grams fat per man per day,
433 grams carbohydrate per man per day,
3424 calories per man per day.

These figures are probably very close to the fact as regards protein and carbohydrate. They are undoubtedly somewhat too high still as regards fat, because the edible wastage of this component is higher than the 25 per cent. used. The intention, however, has been to use the most conservative figures in estimating waste.

For purposes of comparison Table XVI. is inserted. This table is based upon certain American dietary studies analyzed in the writer's statistical laboratory.

The general agreement of these results with those set forth in the present study, which were reached by totally different procedure,

is evident. The statistical estimate of per capita protein consumption over the whole population is distinctly higher than in this small group. The fat consumption is higher but not by so large an amount as protein. The farmers and professional men show a higher net energy intake than the general average for the whole country, which would, of course, be expected. Mechanics are a little lower than the average for the country in energy intake.

In any case there is one fact which must not be lost sight of, namely, that while the figures of Table XV. do in fact represent

TABLE XVI.

SUMMARY OF SOME DIETARY STUDIES IN 11 GROUPS AND 116 FAMILIES.

	No. of Families.	Average Yearly Income.	Days per Man.	Per Man per Day.			
				Protein, Grams.	Fat, Grams.	Carbohydrate, Grams.	Energy, Calories.
Mother wage earners	8	$ 640	212	105	65	472	2,895
Garment makers	7	724	168	109	81	495	3,145
Laborers	6	1,497	305	94	102	479	3,210
Retired	5	1,647	130	81	121	420	3,095
Clerks (office)	11	1,934	225	92	120	419	3,125
Mechanics	8	2,133	259	97	113	460	3,245
Teachers	32	2,150	620	88	125	430	3,195
Professional men	17	2,208	438	99	148	438	3,480
Engineers (professional)	5	2,253	97	85	128	395	3,070
Salesmen	5	2,527	121	90	111	405	2,980
Farmers	12		384	102	131	506	3,610
Average	116	$1,771[11]	260	95	113	447	3,185

[11] Average of 104 families (farmers excluded).

ingestion *and* waste, it still is true, and the constancy of the figures in successive years proves its truth, that to maintain naturally a contented feeling in respect of nutrition the population actually uses up the amounts of nutrients indicated in Table XV. To make these gross consumption figures materially less would require a profound readjustment of the dietary and culinary habits of the people, fixed by centuries of usage. Discussion of the minimum protein, fat and carbohydrate requirements of a nation are in considerable degree academic if they base themselves upon net consumption rather than gross consumption. A considerable excess over any agreed upon minimum *physiological* requirements must always be allowed, be-

cause there will inevitably be, in fact, a margin between actual gross consumption and net physiological ingestion or utilization. The present study, through the figures summarized in Table XV. gives a clearer and probably more nearly exact picture of what this margin between net and gross consumption must be, in a population of the habits of the American people, than has hitherto been available. It may well be theoretically true that a man needs only 75 grams or 50 grams of protein per day to sustain life and health, but in actual

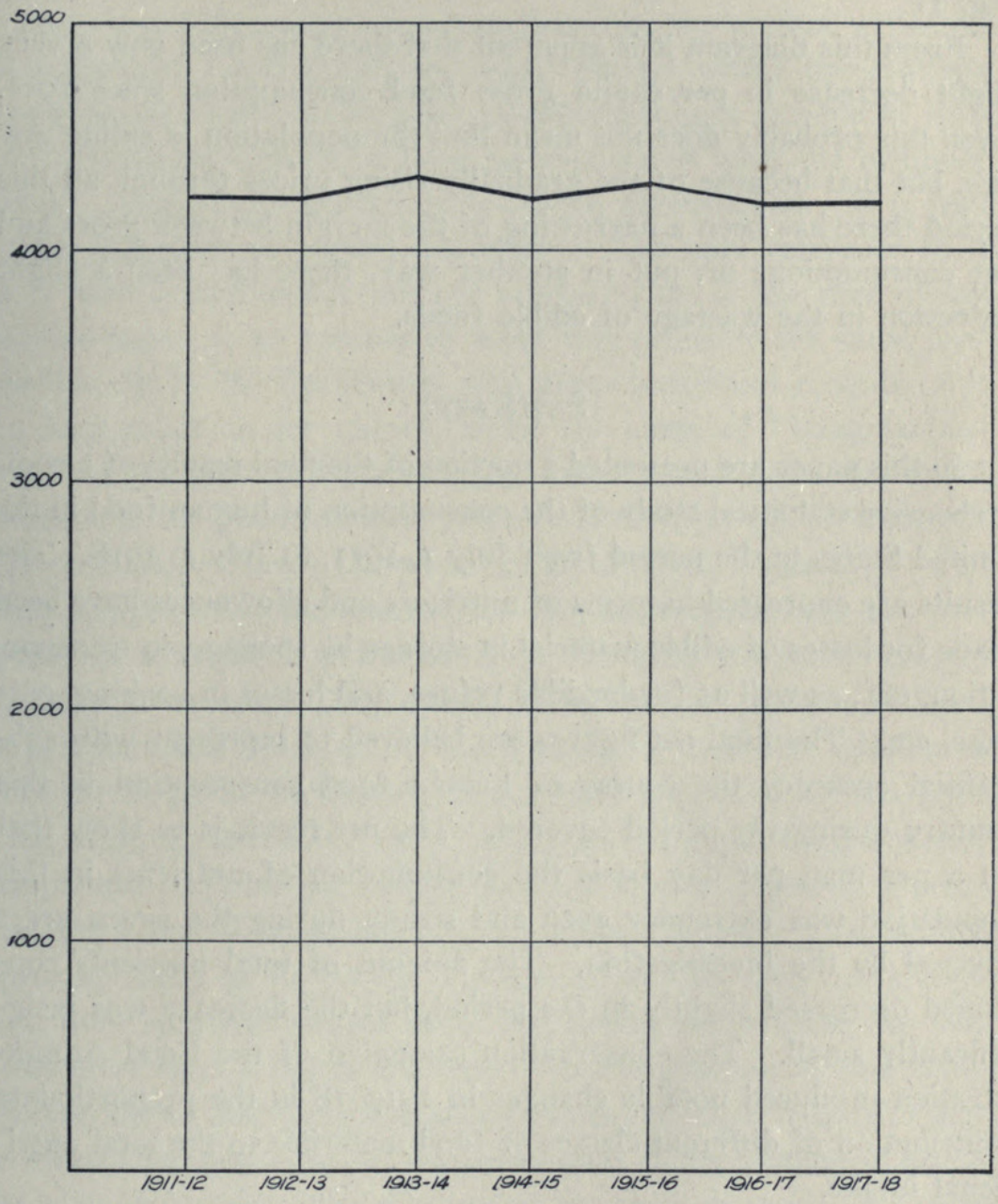

FIG. 11. Diagram showing the energy value in calories of the gross consumption of human food, per adult man per day.

fact the American man uses up, in one way or another, about 120 grams a day. Furthermore, if the last seven years' experience is any criterion, he will continue to use up about 120 grams per diem until such time as his general habits of life are in some manner rather profoundly changed. Doubtless they can be changed. But until they are, one must count on supplying about 120 grams of protein per day to each man equivalent component of the population.

The data of Table XV. for calories are shown graphically in Fig. 11.

From this diagram it is apparent that there has been only a very slight decrease in per capita gross food consumption since 1911. Even this probably does not mean that the population is eating any less, but that because of the gradually rising prices through all this period there has been a narrowing of the margin between gross and net consumption; or, put in another way, there has been a slight reduction in the wastage of edible foods.

Summary.

In this paper are presented a portion of the final results of a comprehensive statistical study of the consumption of human food in the United States in the period from July 1, 1911, to July 1, 1918. The results are expressed in terms of nutrients and allowances have been made for losses of edible material in storage by spoilage, in transportation, etc., as well as for inedible refuse, and losses in cooking, garbage, etc. The final net figures are believed to represent with substantial accuracy the course of human food consumption in this country during the period covered. The net result is to show that on a per man per day basis the consumption of nutrients in this population was extremely even and steady during the seven years covered by the investigation. The amount of total nutrients consumed decreased slightly in the period, but the decrease was insignificantly small. The conservation campaign of the Food Administration produced notable changes in 1917–18 in the proportionate contribution of different classes of food materials to the total nutritional intake.