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# FOODS FOR MAN.

PREPARED IN THE OFFICE OF EXPERIMENT STATIONS.

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### FOODS FOR MAN.

Ordinary food materials, such as meat, fish, eggs, potatoes, wheat, etc., consist of—

*Refuse.*—As the bones of meat and fish, shells of shellfish, skins of potatoes, bran of wheat, etc.

*Edible portion.*—As the flesh of meat and fish, the white and yolk of eggs, wheat flour, etc. The edible portion consists of water and nutritive ingredients, or nutrients. The nutritive ingredients are *protein, fats, carbohydrates, and mineral matters.*

The water, refuse, and salt of salted meat and fish are called nonnutrients. In comparing the values of different food materials for nourishment they are left out of account.

USES OF NUTRIENTS.

Food is used in the body to build and repair tissue and to furnish energy. The manner in which the valuable constituents are utilized in the body may be expressed in tabular form as follows:

Protein .....	Forms tissue (muscles, tendon, and probably fat).	All serve as <i>fuel</i> and yield energy in form of heat and muscular strength.
White (albumen) of eggs, curd (casein) of milk, lean meat, gluten of wheat, etc.		
Fats .....	Form fatty tissue.	
Fat of meat, butter, olive oil, oils of corn and wheat, etc.		
Carbohydrates .....	Transformed into fat.	
Sugar, starch, etc.		
Mineral matters (ash) .....	Aid in forming bone, assist in digestion, etc.	
Phosphates of lime, potash, soda, etc.		

*The fuel value of food.*—Heat and muscular power are forms of force or energy. The energy is developed as the food is consumed in the body. The unit commonly used in this measurement is the calorie, the amount of heat which would raise the temperature of a pound of water 4° F.

The following general estimate has been made for the average amount of potential energy in 1 pound of each of the classes of nutrients:

	Calories.
In 1 pound of protein .....	1,860
In 1 pound of fats .....	4,220
In 1 pound of carbohydrates .....	1,860

In other words, when we compare the nutrients in respect to their fuel values, their capacities for yielding heat and mechanical power, a pound of protein of lean meat or albumen of egg is just about equivalent to a pound of sugar or starch, and a little over 2 pounds of either would be required to equal a pound of the fat of meat or butter or the body fat.

Within recent years analyses of a large number of samples of foods have been made in this country. In the table below the average results of a number of these analyses are given.

*Average composition of American food products.*<sup>1</sup>

Food materials (as purchased).	Refuse.	Water.	Protein.	Fat.	Carbohydrates.	Ash.	Fuel value per pound.
ANIMAL FOOD.							
<b>Beef, fresh:</b>							
Chuck, including shoulder .....	<i>Per cent.</i> 19.9	<i>Per cent.</i> 54.1	<i>Per cent.</i> 15.3	<i>Per cent.</i> 9.9	.....	0.8	705
Chuck ribs .....	13.3	50.1	15.0	20.8	.....	.8	1,155
Flank .....	3.8	54.4	16.7	24.3	.....	.8	1,335
Loin .....	12.6	53.3	15.9	17.3	.....	.9	1,025
Neck .....	28.4	46.3	13.9	10.7	.....	.7	710
Ribs .....	20.2	44.9	13.6	20.6	.....	.7	1,120
Ribrolls .....	.....	64.8	18.7	15.6	.....	.9	1,005
Round .....	8.5	63.0	18.7	8.8	.....	1.0	720
Rump .....	18.5	47.3	14.4	19.0	.....	.8	1,070
Shank, fore .....	36.5	44.1	13.1	5.7	.....	.6	485
Shoulder clod .....	14.6	57.9	16.8	9.7	.....	1.0	725
Fore quarter .....	19.8	49.3	14.1	16.1	.....	.7	940
Hind quarter .....	16.3	52.0	15.3	15.6	.....	.8	945

<sup>1</sup> Condensed from detailed tables in Bulletin No. 28 of the Office of Experiment Stations of this Department.

## Average composition of American food products—Continued.

Food materials (as purchased).	Refuse.	Water.	Protein.	Fat.	Carbohydrates.	Ash.	Fuel value per pound.
ANIMAL FOOD—continued.							
Beef, corned, pickled, and dried:							
Corned beef	<i>Per cent.</i> 9.4	<i>Per cent.</i> 49.6	<i>Per cent.</i> 14.2	<i>Per cent.</i> 22.8	<i>Per cent.</i> -----	<i>Per cent.</i> 4.0	<i>Calories.</i> 1,225
Tongue, pickled	6.0	58.9	11.6	19.2	-----	4.3	1,025
Dried, salted, and smoked	-----	50.8	31.8	6.8	0.6	10.0	890
Veal:							
Breast	21.4	53.1	15.1	9.6	-----	.8	685
Leg	10.5	65.0	18.5	5.0	-----	1.0	555
Leg cutlets	4.0	65.6	20.0	9.5	-----	.9	775
Forequarter	24.5	54.2	14.6	6.0	-----	.7	525
Hind quarter	20.7	56.2	15.7	6.6	-----	.8	570
Lamb and mutton:							
Flank	-----	42.0	13.9	43.4	-----	.7	2,090
Leg, hind	13.8	50.3	15.3	19.7	-----	.9	1,115
Shoulder	21.5	47.0	13.4	17.4	-----	.7	985
Fore quarter	21.1	40.6	11.9	25.7	-----	.7	1,305
Hind quarter, without tallow and kidney	16.7	45.6	13.5	23.5	-----	.7	1,245
Pork, fresh:							
Flank cut	71.2	17.0	5.1	6.4	-----	.3	365
Ham	42.4	35.7	10.7	10.6	-----	.6	645
Loin	16.0	42.3	13.5	27.5	-----	.7	1,410
Shoulder	32.5	35.9	10.4	20.7	-----	.5	1,065
Tenderloin	-----	65.1	19.5	14.4	-----	1.0	970
Pork, salted, cured, and pickled:							
Ham, smoked	12.7	35.9	14.1	33.2	-----	4.1	1,665
Shoulder, smoked	18.9	30.7	12.4	33.0	-----	5.0	1,625
Salt pork	-----	7.3	1.8	87.2	-----	3.7	3,715
Bacon, smoked	8.1	17.8	9.6	60.2	-----	4.3	2,720
Soups:							
Celery, cream of	-----	88.6	2.1	2.8	5.0	1.5	250
Meat stew	-----	85.7	4.5	3.5	5.1	1.2	325
Tomato	-----	90.0	1.8	1.1	5.6	1.5	15
Poultry:							
Chicken	30.0	45.6	13.4	10.2	-----	.8	680
Turkey	22.7	42.4	15.7	18.4	-----	.8	1,070
Fish:							
Cod, dressed	29.9	58.5	10.6	.2	-----	.8	205
Halibut, steaks or sections.	17.7	61.9	15.1	4.4	-----	.9	465
Mackerel, whole	44.6	40.4	10.0	4.3	-----	.7	370
Perch, yellow, dressed	35.1	50.7	12.6	.7	-----	.9	265
Shad, whole	50.1	35.2	9.2	4.8	-----	.7	375
Fish, salt:							
Cod	24.9	40.3	16.0	.4	-----	18.4	315
Shellfish:							
Oysters, "solids"	-----	88.3	6.1	1.4	3.3	.9	235
Eggs:							
Hens' eggs	10.5	66.0	13.1	9.5	-----	.9	645
Dairy products, etc.:							
Butter	-----	-----	-----	82.4	-----	-----	3,475
Whole milk	-----	87.0	3.3	4.0	5.0	.7	325
Skim milk	-----	90.5	3.4	.3	5.1	.7	170
Buttermilk	-----	91.0	3.0	.5	4.8	.7	165
Condensed milk	-----	30.5	8.2	7.1	52.3	1.9	1,425
Cream	-----	74.0	2.5	18.5	4.5	.5	910
Cheese	-----	35.6	28.2	32.0	-----	4.2	1,875
VEGETABLE FOOD.							
Flour, meal, etc.:							
Entire wheat flour	-----	12.1	14.2	1.9	70.6	1.2	1,660
Graham flour	-----	11.8	13.7	2.2	70.3	2.0	1,655
Roller process flour	-----	12.5	11.3	1.1	74.6	.5	1,645
Macaroni and vermicelli.	-----	10.8	11.7	1.6	72.9	3.0	1,640
Crushed wheat	-----	10.5	11.9	1.7	74.5	1.4	1,680
Buckwheat flour	-----	14.3	6.1	1.0	77.2	1.4	1,590
Corn meal, bolted	-----	12.9	8.9	2.2	75.1	.9	1,655
Oatmeal	-----	7.2	15.6	7.3	68.0	1.9	1,860
Rice	-----	12.4	7.8	.4	79.0	.4	1,630
Tapioca	-----	11.6	.4	.3	87.5	.2	1,650
Starch	-----	-----	-----	-----	98.0	-----	1,825
Bread, pastry, etc.:							
White bread	-----	35.4	9.5	1.2	52.8	1.1	1,205
Brown bread	-----	40.0	5.0	2.4	50.7	1.9	1,135
Graham bread	-----	32.3	8.5	1.8	55.9	1.5	1,275

<sup>1</sup> Average per cent shell in several determinations.<sup>2</sup> Average per cent butter fat found in the ninety-day Columbian butter test.

## Average composition of American food products—Continued.

Food materials (as purchased).	Refuse.	Water.	Protein.	Fat.	Carbohydrates.	Ash.	Fuel value per pound.
VEGETABLE FOOD—cont'd.							
Bread, pastry, etc.—Cont'd.	<i>Per cent.</i>	<i>Calories.</i>					
Rye bread.....		31.8	10.1	.7	55.9	1.5	1,255
Cake.....		20.4	7.0	8.1	63.4	1.1	1,650
Cream.....		7.0	9.3	13.1	69.2	1.4	2,010
Oyster crackers.....		4.3	11.0	8.8	74.2	1.7	1,955
Soda crackers.....		8.0	10.3	9.4	70.0	1.8	1,900
Pie.....		44.8	4.6	9.5	59.6	1.5	1,220
Sugars:							
Molasses.....		25.7	2.7		68.0	3.6	1,315
Sugar, granulated.....					100.0		1,860
Maple sirup.....					70.1		1,305
Vegetables:							
Beans, dried.....		13.2	22.3	1.8	59.1	3.6	1,590
Beans, Lima, green.....		68.5	7.1	.7	22.0	1.7	570
Beans, string.....		87.3	2.2	.4	9.4	.7	235
Beets.....	20.0	70.0	1.3	.1	7.7	.9	170
Cabbage.....	15.0	76.8	1.8	.3	4.9	1.2	140
Celery.....		94.4	1.4	.1	3.0	1.1	85
Corn, green (sweet), edible portion.....		81.3	2.8	1.1	14.1	.7	330
Cucumbers.....	15.0	81.6	.7	.2	2.1	.4	60
Lettuce.....	18.0	77.1	1.1	.3	2.7	.8	85
Onions.....	10.0	78.6	1.5	.4	8.9	.6	210
Parsnips.....	20.0	63.9	1.3	.5	12.9	1.4	285
Peas ( <i>Pisum sativum</i> ), dried.....		10.8	24.1	1.1	61.5	2.5	1,640
Peas ( <i>Pisum sativum</i> ), green.....	50.0	39.0	2.2	.3	8.0	.5	200
Peas (cowpeas), dried.....		13.0	21.3	1.4	60.9	3.4	1,590
Potatoes.....	15.0	67.1	1.8	.1	15.3	.7	325
Sweet potatoes.....	15.0	58.9	1.5	.6	23.1	.9	480
Spinach.....		92.4	2.1	.5	3.1	1.9	120
Squash.....	50.0	43.3	.8	.3	5.2	.4	125
Tomatoes.....		94.4	.8	.4	3.9	.5	105
Turnips.....	30.0	62.2	1.0	.1	6.1	.6	135
Vegetables, canned:							
Corn, green.....		75.7	2.8	1.3	19.3	.9	465
Peas ( <i>Pisum sativum</i> ), green.....		85.3	3.6	.2	9.8	1.1	255
Tomatoes.....		94.0	1.2	.2	4.0	.6	105
Fruits, berries, etc., fresh:							
Apples.....	25.0	61.5	.4	.4	12.4	.3	255
Bananas.....	40.0	44.5	.7	.5	13.7	.6	290
Grapes.....	25.0	59.1	1.0	1.3	13.3	.3	320
Lemons.....	30.0	62.5	.7	.6	5.8	.4	145
Oranges.....	27.0	64.5	.6	.4	7.1	.4	160
Pears.....	25.0	62.9	.5	.6	10.6	.4	235
Raspberries.....		85.8	1.0		12.6	.6	255
Strawberries.....	10.0	81.8	.9	.6	6.1	.6	155
Watermelons.....	58.0	39.0	.2		2.7	.1	55
Fruits, dried:							
Apples.....		36.2	1.4	3.0	57.6	1.8	1,225
Dates.....	12.0	18.3	1.9	4.5	61.9	1.4	1,375
Figs.....		22.5	5.1		70.0	2.4	1,395
Raisins.....		14.0	2.5	4.7	74.7	4.1	1,635
Miscellaneous:							
Cocconut, prepared.....		3.5	6.3	57.4	31.5	1.3	3,125
Chocolate.....		10.3	12.5	47.1	26.8	3.3	2,720
Cocoa, powdered.....		4.6	21.6	28.9	37.7	7.2	2,320

<sup>1</sup> Average of a number of kinds.

## DIETARY STANDARDS.

Dietary studies have been made in considerable numbers in different countries, The results of such studies and experiments to determine the amount of food required by men engaged in different occupations have resulted in the adoption of dietary standards. Some of these follow.

*Standards for daily dietaries.*

	Nutrients.			Fuel value.
	Protein.	Fat.	Carbohy- drates.	
European:	<i>Found.</i>	<i>Pound.</i>	<i>Pounds.</i>	<i>Calories.</i>
Man at moderate work.....	0.26	0.12	1.10	3,055
Man at hard work.....	.32	.22	.99	3,370
American:				
Man without muscular work.....	.20	-----	-----	3,000
Man with light muscular work.....	.22	-----	-----	3,000
Man with moderate muscular work.....	.28	-----	-----	3,500
Man with hard muscular work.....	.39	-----	-----	4,500

The table of composition of food materials shows the amount of water, protein, fat, carbohydrates, and ash content and the total fuel value per pound. The protein, fat, and carbohydrates all furnish energy. In addition to furnishing energy, protein forms tissue. Since protein and energy are the essential features of food, dietary standards may be expressed in their simplest form in terms of protein and energy alone.

Observation has shown that as a rule a woman requires less food than a man, and the amount required by children is still less, varying with the age. It is customary to assign certain factors which shall represent the amount of nutrients required by children of different ages and by women as compared with adult man. The various factors which have been adopted are as follows:

*Factors used in calculating meals consumed in dietary studies.*

- One meal of woman equivalent to 0.8 meal of man at moderate muscular labor.
- One meal of boy 14 to 16 years of age, inclusive, equivalent to 0.8 meal of man.
- One meal of girl 14 to 16 years of age, inclusive, equivalent to 0.7 meal of man.
- One meal of child 10 to 13 years of age, inclusive, equivalent to 0.6 meal of man.
- One meal of child 6 to 9 years of age, inclusive, equivalent to 0.5 meal of man.
- One meal of child 2 to 5 years of age, inclusive, equivalent to 0.4 meal of man.
- One meal of child under 2 years of age equivalent to 0.3 meal of man.

These factors are based in part upon experimental data and in part upon arbitrary assumptions. They are subject to revision when experimental evidence shall warrant more definite conclusions.

## METHOD OF CALCULATING DIETARIES.

The following may be taken as an illustration of the way in which the table of composition of food products and the dietary standards may be practically applied. Suppose the family consists of four adults and that there are on hand or may be readily purchased the following food materials: Oatmeal, milk, sugar, eggs, lamb chops, roast beef, potatoes, sweet potatoes, rice, bread, cake, bananas, tea, and coffee. From these materials menus for three meals might be arranged as follows:

*Breakfast.*—Oatmeal, milk, sugar, lamb chops, bread, butter, and coffee.

*Dinner.*—Roast beef, white (Irish) potatoes, sweet potatoes, rice pudding, and tea.

*Supper.*—Bread, butter, cake, and bananas.

The amounts required of the several articles of food may be readily approximated by any person experienced in marketing or preparing food for a family. Thus, it may be assumed that four adults would consume for breakfast  $1\frac{1}{2}$  pounds lamb chops, one-half pound oatmeal, one-half pound bread, 6 ounces milk, 2 ounces sugar, and 2 ounces butter. From the table of composition of food materials the nutritive ingredients which these foods furnish may be easily calculated. Thus,

if oatmeal contains 15.6 per cent protein and furnishes 1,860 calories per pound, one-half pound would contain 0.078 pound protein ( $0.5 \text{ lb.} \times 0.156 = 0.078 \text{ lb.}$ ) and yield 930 calories, and if lamb chops contain 15.3 per cent protein and furnish 1,115 calories per pound,  $1\frac{1}{2}$  pounds of lamb chops would furnish 0.23 pound protein ( $1.5 \text{ lb.} \times 0.153 = 0.2295 \text{ lb.}$ ) and 1,673 calories. The others may be calculated in the same way.

The assumed quantities of food materials which the four persons would consume in a day and the calculated protein content and fuel value would be as follows :

*Menu for family of four adults for one day.*

Food materials.	Weights.		Protein.	Fuel value.
	Pounds.	Ounces.	Pound.	Calories.
<b>Breakfast:</b>				
Oatmeal.....		8	0.078	930
Milk.....		6	.017	122
Sugar.....		2		232
Lamb chops (from leg).....	1	8	.229	1,673
Bread.....		8	.048	603
Butter.....		2		434
Coffee <sup>1</sup> .....			.010	417
Total.....			.382	4,411
<b>Dinner:</b>				
Roast beef (chuck).....	1	12	.270	1,233
Potatoes.....		12	.013	244
Sweet potatoes.....		12	.011	360
Bread.....		6	.036	453
Butter.....		2		434
Rice.....		4	.020	407
Eggs.....		4	.033	161
Milk.....		6	.012	122
Sugar.....		2		232
Tea.....			.010	410
Total.....			.405	4,056
<b>Supper:</b>				
Bread.....		12	.071	904
Butter.....		2		434
Bananas.....		12	.005	217
Cake.....		8	.035	835
Total.....			.111	2,380
Total for 3 meals.....			.898	10,847
Average for 1 person.....			.299	3,616

<sup>1</sup> Coffee and tea in themselves have little or no nutritive value. In the menu, allowance is made for the milk or cream and the sugar that would ordinarily be added.

The American dietary standard for a man at moderate muscular work calls for 0.28 pound protein and 3,500 calories. It will be seen that the menu suggested above is insufficient, that is, more food must be supplied. For instance, cheese might be added for dinner and pork and beans and milk for supper. The amounts of protein and energy which a sufficient quantity of these articles for four persons would supply are shown in the following table:

*Food added to bring the day's menu up to the dietary standard.*

Food materials.	Weights.		Protein.	Fuel value.
	Pounds.	Ounces.	Pound.	Calories.
Cheese.....		44	0.073	553
Beans.....		12	.167	1,193
Pork.....		4	.004	829
Milk.....	2		.017	650
Total amount added to menu.....			.251	3,225

These additions would make the total protein 1.149 pounds and the total fuel value 14,072 calories for four persons, or for one person<sup>1</sup> 0.287 pound protein and 3,518 calories, which are approximately the amounts required by the dietary standard.

Following the above method the value of any menu chosen may be easily calculated. It should be borne in mind that approximate rather than absolute agreement with the dietary standard is sought. It is not the purpose to furnish a prescription for definite amounts of food materials, but rather to supply the means of judging whether the food habits of families accord in general with what research has shown to be most desirable from a physiological standpoint. If economy is necessary a study of the tables will show that it is possible to devise menus which will furnish the requisite amounts of nutrients and energy at comparatively low cost.