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United States Department of Agriculture,

OFFICE OF EXPERIMENT STATIONS,

A. C. TRUE, Director.

FOOD—NUTRIENTS—FOOD ECONOMY.

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

Refuse.—As the bones of meat and fish, shells of shellfish, skin 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 principal kinds of nutritive ingredients are *protein*, *fats*, *carbohydrates*, and *mineral matters*.

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

CLASSES OF NUTRIENTS.

The following are familiar examples of compounds of each of the four principal classes of nutrients:

PROTEIN.	{	<i>Proteids.</i>	{	Albuminoids, e. g., albumen (white of eggs); casein (curd) of milk; myosin, the basis of muscle (lean meat); gluten of wheat, etc.
				Gelatinoids, e. g., collagen of tendons; ossein of bones; which yield gelatin or glue, etc.
				Meats and fish contain very small quantities of so-called "extractives." They include creatin and allied compounds, and are the chief ingredients of beef tea and meat extract. They contain nitrogen, and hence are commonly classed with protein.
				FATS, e. g., fat of meat; fat (butter) of milk; olive oil; oil of corn, wheat, etc.
				CARBOHYDRATES, e. g., sugar, starch, cellulose (woody fiber), etc.
				MINERAL MATTERS, e. g., phosphate of lime, sodium chlorid (common salt), etc.

USES OF THE DIFFERENT CLASSES OF NUTRIENTS.

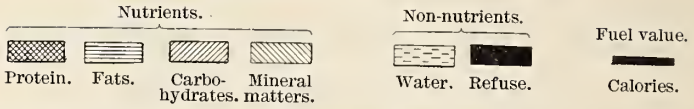
Protein forms tissue (muscle, tendon, etc., and fat) and serves as fuel.	} All yield energy in form of heat and muscular strength.
Fats form fatty tissue (not muscle, etc.) and serve as fuel.	
Carbohydrates are transformed into fat and serve as fuel.	

DEFINITION OF FOOD AND FOOD ECONOMY.

Food is that which, taken into the body, builds tissue or yields energy. The most healthful food is that which is best fitted to the wants of the user. The cheapest food is that which furnishes the largest amount of nutriment at the least cost. The best food is that which is both most healthful and cheapest.

COMPOSITION OF FOOD MATERIALS.

Nutritive ingredients, refuse, and fuel value.



Protein compounds, e. g., lean of meat, white of egg, casein (curd) of milk, and gluten of wheat, make muscle, blood, bone, etc.
Fats, e. g., fat of meat, butter, and oil, }
Carbohydrates, e. g., starch and sugar, } serve as fuel to yield heat and muscular power.





Nutrients, etc., p. ct.	10	20	30	40	50	60	70	80	90	100
Fuel value of 1 lb.	400	800	1200	1600	2000	2400	2800	3200	3600	4000
Beef, round										
Beef, round *										
Beef, sirloin										
Beef, sirloin *										
Beef, rib										
Beef, rib *										
Mutton, leg										
Pork, spare rib										
Pork, salt										
Ham, smoked										
Codfish, fresh										
Codfish, salt										
Oysters										
Milk										
Butter										
Cheese										
Eggs										
Wheat bread										
Wheat flour										
Corn meal										
Oat meal										
Beans, dried										
Rice										
Potatoes										
Sugar										

* Without bone.

PECUNIARY ECONOMY OF FOOD.

































Amounts of actually nutritive ingredients obtained in different food materials for 10 cents.

Protein. Fats. Carbohydrates. Fuel value.

Protein compounds, e. g., lean of meat, white of egg, casein (curd) of milk, and gluten of wheat, make muscle, blood, bone, etc.

Fats, e. g., fat of meat, butter, and oil, } serve as fuel to yield heat and muscular power.
Carbohydrates, e. g., starch and sugar, }

	Price per pound.	Ten cents will buy—	Pounds of nutrients and calories of fuel value in 10 cents' worth.			
	Cents.	Lbs.	1 Lb. 2000 Cal.	2 Lbs. 4000 Cal.	3 Lbs. 6000 Cal.	4 Lbs. 8000 Cal.
Beef, round	12	.83				
Beef, sirloin	18	.55				
Beef, rib	16	.63				
Mutton, leg	12	.83				
Pork, spare rib	12	.83				
Pork, salt, fat	14	.71				
Ham, smoked	16	.63				
Codfish, fresh	8	1.25				
Codfish, salt	6	1.67				
Oysters, 40 cents quart.	20	.50				
Milk, 6 cents quart	3	3.33				
Butter	24	.42				
Cheese	16	.63				
Eggs, 25 cents dozen	16½	.60				
Wheat bread	4	2.50				
Wheat flour	2½	4.00				
Corn meal	2	5.00				
Oat meal	4	2.50				
Beans, white, dried	4	2.50				
Rice	5	2.00				
Potatoes, 60 cents bushel	1	10.00				
Sugar	5	2.00				

Classification of food materials by composition.

GRADATION BY AMOUNTS OF PROTEIN.	GRADATION BY FUEL VALUES.
VERY LARGE.	
Canned corned beef; cheese; beans, dry.	Butter; salt pork; cheese; smoked ham; crackers; sugar; oatmeal.
LARGE.	
Canned salmon; beef, round; beef, sirloin; salt codfish; beef, chuck.	Pork, spare rib; corn (maize) meal; wheat flour; rice; beans, dry; wheat bread.
MEDIUM.	
Mutton, leg; pork, spare rib; beef, rib; eggs; fresh codfish; oatmeal; wheat flour.	Canned corned beef; beef, rib; beef, sirloin; canned salmon; beef, chuck; mutton, leg; beef, round; eggs.
SMALL.	
Smoked ham; wheat bread; milk crackers; corn (maize) meal; rice.	Milk; salt codfish; potatoes.
VERY SMALL.	
Oysters; salt pork; milk; butter; potatoes; sugar.	Oysters; fresh codfish.

Classification of food materials by cost of actual nutriment: i. e., by cost of protein and energy (fuel value) at assumed prices per pound of the food materials.

GRADATION BY COST OF PROTEIN AT PRICES STATED PER POUND.	GRADATION BY COST OF ENERGY (FUEL VALUE) SUPPLIED AT PRICES STATED PER POUND.
VERY CHEAP.	
Salt codfish, at 6 cents per pound; beans, dry, 4 cents; wheat flour, 2½ cents; oatmeal, 4 cents; corn meal, 2 cents; wheat bread, 4 cents.	Wheat flour, at 2½ cents per pound; corn meal, 2 cents; oatmeal, 4 cents; beans, dry, 4 cents; sugar, 5 cents; rice, 5 cents; potatoes (60 cents bushel), 1 cent; wheat bread, 4 cents.
CHEAP.	
Canned corned beef, at 12 cents per pound; milk (4 cents quart), 2 cents; skim milk (3 cents quart), 1½ cents; potatoes (60 cents bushel), 1 cent.	Salt pork, at 12 cents per pound; crackers, 9 cents; wheat bread, 6 cents.
MEDIUM.	
Cheese, at 16 cents per pound; beef, chuck, 12 cents; beef, round, 12 cents; fresh codfish, 8 cents; wheat bread, 6 cents; rice, 5 cents.	Butter, at 24 cents per pound; cheese, 16 cents; smoked ham, 16 cents; pork, spare rib, 12 cents; skim milk (3 cents quart), 1½ cents; milk (4 or 6 cents quart), 2 or 3 cents.
EXPENSIVE.	
Mutton, leg, at 12 cents per pound; pork, spare rib, 12 cents; milk (6 cents quart), 3 cents; crackers, 9 cents.	Canned corned beef, at 12 cents per pound; beef, chuck, 12 cents; mutton, leg, 12 cents; beef, rib, 16 cents; beef, round, 12 cents; beef, sirloin, 18 cents; salt codfish, 6 cents.
VERY EXPENSIVE.	
Smoked ham, at 16 cents per pound; salt pork, 12 cents; oysters, 30 cents quart.	Fresh codfish, at 8 cents per pound; oysters, 30 cents quart.

LIST OF PUBLICATIONS OF THE OFFICE OF EXPERIMENT STATIONS ON THE FOOD AND NUTRITION OF MAN.¹

- Charts. Food and Diet. By W. O. Atwater. (Four charts, 26 by 40 inches.)
Price per set, unmounted, 75 cents.
- Bul. 21. Methods and Results of Investigations on the Chemistry and Economy
of Food. By W. O. Atwater. Pp. 222. Price, 15 cents.
- Bul. 28. (Revised edition.) The Chemical Composition of American Food Mate-
rials. By W. O. Atwater and A. P. Bryant. Pp. 87. Price, 5 cents.
- Bul. 29. Dietary Studies at the University of Tennessee in 1895. By C. E. Wait,
with comments by W. O. Atwater and C. D. Woods. Pp. 45. Price,
5 cents.
- Bul. 31. Dietary Studies at the University of Missouri in 1895, and Data Relating
to Bread and Meat Consumption in Missouri. By H. B. Gibson, S.
Calvert, and D. W. May, with comments by W. O. Atwater and C. D.
Woods. Pp. 24. Price, 5 cents.
- Bul. 32. Dietary Studies at Purdue University, Lafayette, Ind., in 1895. By
W. E. Stone, with comments by W. O. Atwater and C. D. Woods.
Pp. 28. Price, 5 cents.
- Bul. 35. Food and Nutrition Investigations in New Jersey in 1895 and 1896. By
E. B. Voorhees. Pp. 40. Price, 5 cents.
- Bul. 37. Dietary Studies at the Maine State College in 1895. By W. H. Jordan.
Pp. 57. Price, 5 cents.
- Bul. 38. Dietary Studies with reference to the Food of the Negro in Alabama in
1895 and 1896. Conducted with the Cooperation of the Tuskegee
Normal and Industrial Institute and the Agricultural and Mechanical
College of Alabama. Reported by W. O. Atwater and C. D. Woods.
Pp. 69. Price, 5 cents.
- Bul. 40. Dietary Studies in New Mexico in 1895. By A. Goss. Pp. 23. Price,
5 cents.
- Bul. 43. Losses in Boiling Vegetables and the Composition and Digestibility of
Potatoes and Eggs. By H. Snyder, A. J. Frisby, and A. P. Bryant.
Pp. 31. Price, 5 cents.
- Bul. 44. Report of Preliminary Investigations on the Metabolism of Nitrogen
and Carbon in the Human Organism with a Respiration Calorimeter
of Special Construction. By W. O. Atwater, C. D. Woods, and F. G.
Benedict. Pp. 64. Price, 5 cents.
- Bul. 45. A Digest of Metabolism Experiments in which the Balance of Income
and Outgo was Determined. By W. O. Atwater and C. F. Lang-
worthy. Pp. 334. Price, 25 cents.
- Bul. 46. Dietary Studies in New York City in 1895 and 1896. By W. O. Atwater
and C. D. Woods. Pp. 117. Price, 10 cents.
- Bul. 52. Nutrition Investigations in Pittsburg, Pa., 1894-1896. By Isabel Bevier,
Pp. 48. Price, 5 cents.
- Bul. 53. Nutrition Investigations at the University of Tennessee in 1896 and 1897.
By C. E. Wait. Pp. 46. Price, 5 cents.

¹ For those publications to which a price is affixed application should be made to the Superin-
tendent of Documents, Union Building, Washington, D. C., the officer designated by law to sell
Government publications.

- Bul. 54. Nutrition Investigations in New Mexico in 1897. By A. Goss. Pp. 20. Price, 5 cents.
- Bul. 55. Dietary Studies in Chicago in 1895 and 1896. Conducted with the Cooperation of Jane Addams and Caroline L. Hunt, of Hull House. Reported by W. O. Atwater and A. P. Bryant. Pp. 76. Price, 5 cents.
- Bul. 56. History and Present Status of Instruction in Cooking in the Public Schools of New York City. Reported by Mrs. Louise E. Hogan, with an introduction by A. C. True, Ph. D. Pp. 70. Price, 5 cents.
- Bul. 63. Description of a New Respiration Calorimeter and Experiments on the Conservation of Energy in the Human Body. By W. O. Atwater and E. B. Rosa. Pp. 94. Price, 10 cents.
- Bul. 66. The Physiological Effect of Creatin and Creatinin and their Value as Nutrients. By J. W. Mallet. Pp. 24. Price, 5 cents.
- Bul. 67. Studies on Bread and Bread Making. By Harry Snyder and L. A. Voorhees. Pp. 51. Price, 10 cents.
- Bul. 68. A Description of Some Chinese Vegetable Food Materials and their Nutritive and Economic Value. By Walter C. Blasdale. Pp. 48. Price, 10 cents.
- Bul. 69. Experiments on the Metabolism of Matter and Energy in the Human Body. By W. O. Atwater and F. G. Benedict, with the cooperation of A. W. Smith and A. P. Bryant. Pp. 112. Price, 10 cents.

FARMERS' BULLETINS.

- Bul. 23. Foods: Nutritive Value and Cost. By W. O. Atwater. Pp. 32.
- Bul. 34. Meats: Composition and Cooking. By C. D. Woods. Pp. 29.
- Bul. 74. Milk as Food. Pp. 39.
- Bul. 85. Fish as Food. By C. F. Langworthy. Pp. 30.
- Bul. 93. Sugar as Food. By Mary H. Abel. Pp. 27.

SEPARATES.

- Food and Diet. By W. O. Atwater. Reprinted from Yearbook of Department of Agriculture for 1894.
- Foods for Man. Pp. 7. Reprinted from Yearbook of Department of Agriculture for 1897.
- Some Results of Dietary Studies in the United States. By A. P. Bryant, Office of Experiment Stations. Pp. 14. Reprinted from Yearbook of Department of Agriculture for 1898.

Recommended for publication.

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Publication authorized:

JAMES WILSON,
Secretary of Agriculture.

WASHINGTON, D. C., *October 31, 1899.*