SCIENCE MEASURES THE ENERGY STORED IN VARIOUS FOODS.

Interesting Results Given from Recent Government Experiments with the Calorimeter.

THE high cost of living and the firm upward tendency of the prices of common staples of food during the past year have given new value to many purely scientific investigations in regard to dietary value of various staple foods. Among these no one is of more lasting importance to not only the American people but to all civilized populations than the series of experiments begun eighteen years ago at Middletown by the late Prof. W. O. Atwater and Prof. E. B. Rosa, both members of the Faculty of Wesleyan University.

Later these experiments were continued by Prof. C. D. Woods, Dr. F. G. Benedict, Dr. Thorne M. Carpenter of the Carnegie Institution, and Dr. C. F. Langworthy, now expert in charge of nutrition experiments at the Department of Agriculture. These experiments, after an interval following the death of Prof. Atwater, have been resumed under the direction of Dr. Langworthy at the Department of Agriculture in Washington.

The main purpose of these experiments is to determine as accurately as practicable the income and outgo of energy from various foods when eaten by human subjects. The apparatus is complicated and has involved much expense.

The work is done by means of what is called the respiration calorimeter. In ordinary experiments to discover the energy value of foods what is known as the bomb calorimeter is employed.

In making these experiments a man is shut in an apartment that is sealed hermetically and supplied with air, food and drink.

We often read of solitary confinement, and the thought of being shut up from the world strikes terror to any heart. But there seem to be no terrors about the imprisonment that these calorimeter experiments require.

There are in all sixteen or seventeen young men connected with the laboratory where these tests are going on, and any one of them seems to be willing, as an ordinary matter of daily routine duty, to go into the box to be sealed up for a week or two without a qualm of apprehension. "There is no trouble at all about that," says Dr. Langworthy. "All our staff are interested in these experiments as a scientific matter."

While the man within is reading or writing or attending to the numerous small duties connected with the care of himself, for he must weigh himself, stripped and dressed, twice a day, must note his bodily temperature and keep track of many other conditions connected with the experiment, those on the outside are busy with a long programme of work that must be done regularly every hour of the many days that some of the experiments are under headway. For instance, the thermometer in most of the experiments is read every two minutes, and the reading set down carefully.

The air as it comes from the chamber is conducted through pipes and first is deprived of its water by being run through jars containing sulphuric acid. Then it is passed through caustic lime and soda and the carbon dioxide taken from it.

The same air is sent on into the chamber again for the man within to breathe, the requisite amount of oxygen having been added to it. The pumps by which the air is sent into the chamber are operated by electric motors. Indeed, it is now very much easier to perform some of the operations connected with the experiments than it was in 1882, when the work first began, because of the very convenient application of electricity in the most common modes of using power.

The large respiration calorimeter does in the case of the combustion of foods in the human body just what the bomb calorimeter does when the same substances are consumed by the electric current in that instrument. It makes a study of the heat given off by the body on different diets, in different conditions of work and rest, during sleeping, waking, while reading or in mental work, such as an examination in mathematics or physics, or in hard physical labor.

The force detailed to the work with the calorimeter is divided into relays for work in the day time and at night. There is no "squad" of subjects, as was the case in the digestion experiments conducted by Dr. Wiley in recent years, but the various members of the staff connected with the office of Nutrition Experiments take turns in undergoing the ordeal of confinement in the hermetically sealed prison house.

Books have been necessary to recount the discoveries resulting from the use of the respiration calorimeter, and many more will be forthcoming when the present series of experiments undertaken by Dr. Langworthy is under headway. The series as mapped out at present embraces the determination of the food value for the production of physical energy of cheese, which we generally regard as of itself not so entirely digestible, but in combination with other foods of distinct importance in digestion.

In the list also are a number of foods that just now are of special interest for the purpose of avoiding the use of meats in the diet of laborers. These are lard, olive oil, beef suet, butter, peanut butter, cottonseed productions, and other culinary fats. Fruits and nuts also will be studied, and important additions made to determinations that have hitherto been made along this line.

Dr. Langworthy has given us many facts about the value of nuts as food, and he has many believers in this diet to his credit. Among them is one United States Senator who, to judge by his activity and the amount of salutary legislation he has forced on the statute books, is a worthy exhibit in the case. Measured by their value in energy and by their cost, cocoanuts, hickory nuts, chestnuts, peanuts, pecans, walnuts, and almonds have far more value than porterhouse steak. Ten cents expended for peanuts will buy 2,767 calories, which is enough to supply a scund, full-sized working man for a day.

Going on from this, however, dried beans at 5 cents a pound, for the investment of 10 cents will supply energy equivalent to 3,200 calories. Even the acorn, which we think is good to feed the pig that becomes Smithfield ham, has 1,265 calories per pound.

Of all the nuts available in the market the Brazil nut, butternut, filbert, hickory nut, walnut, almond, and peanut are the most valuable measured by their calories. Almond butter, hazelnut meal, peanut butter, and peanut coffee are especially good foods.

Some things of peculiar interest to the lay mind result from these experiments. For instance, it has been discovered that a certain amount of energy is required from the food-fuel we consume to overcome the friction of the muscles in labor. This is from 158 to 242 calories.

A considerable amount of energy goes into perspiration, and the clothes of the subject are carefully washed and the amount of perspiration weighed after every labor test. The apparatus takes into account practically every physical outgiving of the body, and if a subject were to spend his time in tears they, too, would be measured as a part of the experiment.

Athletes accustomed to bicycle racing have been in the chamber for six or seven days at a time. They complain of the monotony and say that the sight of a crowd of spectators and the shouting of the crowd have a most important effect on the ability to put forth energy. In the chamber while working against a current of 1.25 amperes they said they were riding as hard as they would to have won a six-day race.

One of the most informing phenomena coming from the experiments bears on the subject of ventilation. Men in the chamber, without their knowledge of the fact, have been allowed to remain when there has been more than the amount of carbon dioxide, which we usually regard as possible for us to breathe.

To test this ability to endure vitiated air a subject was made to wear a light mask with air pipes connected to the outside through which he had to breathe. For twenty-four hours he breathed this way, and then the mask was removed and he breathed the air in the chamber.

Normal air contains three parts of carbon dioxide to 10,000 parts. It has been supposed that we could endure eight or ten times the normal amount, and for short periods possibly fifty or sixty times as much.

In the experiments with the respiration calorimeter it was found that the inmate of the chamber, without any distress, and without knowing it, lived in an atmosphere containing 226 parts of carbon dioxide. The man read, slept, wrote, talked through the telephone, ate as usual, and seemed to experience no difficulty whatever.

The New York Times
Published: June 26, 1910
Copyright © The New York Times