

INFLUENCE OF HEAT ON GROWTH-PROMOTING PROPERTIES OF FOOD.

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SINCE the war began, I have felt it my duty to take advantage of every opportunity to give to the public all the useful information which my associates and I have gained through our elaborate investigations in nutrition problems. The Food Administration has been active in pointing out the serious shortage of some of our staple foodstuffs, and the need of eliminating waste and of preserving perishable food products, such as fruits and vegetables, by canning and drying, and of replacing wheat in our diets to some extent by other less used grains. I have made a special effort to point out what constitutes a safe diet, and to make clear the danger of restricting the food supply in too great a degree to the cereal grains and their products.

There is one phase of nutrition concerning which great misunderstanding exists, and I wish to discuss this briefly in the light of the well-controlled experimental evidence bearing upon it. I refer to the popular belief that canned goods sterilized by heat, and heated foods in general, are of inferior quality as compared with unheated. We are, in this country, regularly cooking all foods derived from cereal grains, meats, eggs and fish, all tubers and roots, and most of the products of the garden, with the exception of those things which are used raw in salads. Among un-

cooked foods, only fruits and milk are regularly eaten, and these are the articles which do not find a prominent place in the diet of the city dwellers of limited means.

Many references could be cited in the semi-popular discussions of nutrition, which have appeared in the last five years, to statements regarding the ready destruction by heat of a class of substances usually designated as "vitamines." It has been generally accepted that beri-beri, scurvy, pellagra and rickets, and possibly one or two other diseases, result from the lack in the diet of one or another of these substances, still uncharacterized chemically. Recently Miss Simmonds, Mr. Pitz and I have made it practically certain that there are but two chemically unidentified dietary essentials, and that beri-beri is the only one of the so-called "deficiency diseases" listed above which is actually due to the lack of a specific chemical substance. We have shown that scurvy and pellagra, while due to faulty diet, are not deficiency diseases in the sense which Funk, Williams and others have employed this term.

Beri-beri is in reality due to a shortage in the diet of a chemically unknown substance which is soluble in water and in alcohol, and is found in all natural foods. It is absent, or nearly so, from the manufactured foods, polished rice,

starch, the sugars and the fats of both animal and vegetable origin. This I have called water-soluble B.

There is a second dietary essential to which I have given the name fat-soluble A, which is found in certain animal fats, and in the leaves, but in small and inadequate amounts in most seeds and is absent from all fats and oils from vegetable sources.

The lack of this substance in the diet leads to failure of growth, emaciation and death. The most prominent symptom observed in animals suffering from this specific type of starvation is edema of the eyelids, inflammation of the cornea and ultimate blindness. Butter fat, egg fats, fats from the liver, kidney, etc., or an abundance of food derived from green leafy vegetables quickly relieves the trouble.

We have recently begun an extensive study of the effects of heat of various chemical reagents on these two substances and no extensive discussion of their properties would be warranted at the present time. In view of the urgent need for intensive efforts in canning and drying of fruits and vegetables as a food conservation measure, and the widespread belief that heating destroys the food elements which have been but recently appreciated, it seemed desirable to present at this time such experimental data as is available on this point.

The method of testing for the presence or absence of one or the other of these two dietary essentials is simple. When a young animal is fed a ration of purified protein (casein), carbohydrate (starch or dextrin) and a suitable

inorganic salt mixture, it does not grow and will not long remain alive. When to this mixture a substance or substances containing the unidentified fat-soluble A and water-soluble B is added, growth and well-being result. The presence of either one without the other will not prevent prompt failure of the animal.

To test for the unknown A we feed the purified food mixture described together with a small amount of some natural food rich in the factor water-soluble B, but free, or relatively poor in the factor fat-soluble A (*e. g.*, a seed or an alcoholic extract of some natural food), and to this we add the food to be tested for the fat-soluble A. If the latter is present in sufficient amount growth follows, otherwise failure supervenes. To test for the dietary factor, water-soluble B, the purified food mixture plus butter fat to furnish the factor A is fed with the addition of the substance to be tested.

As an example I may cite the following experiment, in which 25 per cent of navy beans supplied a sufficient amount of the water-soluble B to induce normal growth even after they were heated in an autoclave at 15 pounds pressure. The ration consisted of:

- Casein, 18 per cent,
- Dextrin, 48.3 per cent,
- Butter fat, 5 per cent,
- Cooked beans, 25 per cent,
- A salt mixture, 3.7 per cent.

On this ration growth was approximately normal, and young were produced and successfully reared. The same ration with the beans replaced

by carbohydrate permits speedy decline for lack of the unidentified dietary factor, which protects against polyneuritis, but the latter modification is again efficient in promoting growth when there is added to it an alcoholic extract of almost any natural foodstuff which supplies the missing dietary factor.

In other experiments we have fed peas and also wheat germ, which had been thoroughly cooked by heating in an autoclave at 15 pounds pressure for an hour, and have found that the growth-promoting properties of the peas had not been lost. This treatment subjects the foods to a temperature of between 112° and 115° Centigrade, and is a more severe heat treatment than is ever given to canned goods in processing.

The statement has been made that bread containing baking soda loses the dietary essential in question during baking.* This may well be true, for the experience of several investigators† indicate that extracts of rice polishings which possess marked curative powers when administered to polyneuritic pigeons, lose this property rapidly when they are made alkaline.

When cereals, fruits or vegetables are cooked with water, the reaction of the solution in contact with the food is, I believe, never alkaline. Destruction of the physiologically active substance concerned with the prevention and relief of polyneuritis

is sufficiently stable in either neutral or slightly acid aqueous solutions to make its destruction by heat a relatively slow process.

Another factor which should be mentioned in this connection is the relative abundance of this dietary essential in most natural foodstuffs. We have not yet made an extensive study of the minimum amounts of the more important foods which serve to supply enough of these substances to support growth or maintain well-being in the adult. Numerous experiments have shown that for growth 3 per cent of wheat germ, 10 per cent of beans, 15 per cent of peas, have proven entirely satisfactory for supporting growth when the diet was otherwise of satisfactory quality, and derived its supply of the water-soluble B from such small amounts of natural foodstuff. It seems certain that any diet which contains as much as 30 to 35 per cent of one of the ordinary seeds, will be entirely adequate with respect to this dietary factor. When milk is contained in the diet even in small amounts as in the cooking of foods, the quantity of the water-soluble B, the substance which acts as a protection against beri-beri will ordinarily be present in very liberal amounts, and there is not, in my opinion, the slightest danger of a shortage of this substance in the diet.

Concerning the stability of the fat-soluble A at higher temperatures, we know that butter fat can be maintained for an hour or more at the temperature of boiling water without greatly deteriorating with respect to its peculiar growth promoting properties.

* Voegtlin: Bread as Food, Bull. U. S. Public Health Service, 1916.

† Funk: Biochemical Bulletin, 1915, iv, 306.

Vedder and Williams: Philippine Jour. of Science, 1913, viii, 175.

Voegtlin and Sullivan: Jour. Biol. Chem., Proceedings Soc. Biol. Chem., 1916, xxiv, 16.

Leaf crops such as alfalfa are found by experiment to be still rich in this dietary essential after being cut and dried in the sun in the field. It is, therefore, a fairly stable substance under the ordinary conditions to which foods or feeding stuffs are subjected.

Pending the acquisition of exact data to show whether or not there is slow but progressive destruction of these two as yet unidentified food substances, we may feel confident that the danger of our running short of them as a result of our use of cooked

and canned foods has been decidedly overemphasized.

There is actually a practical dietetic problem in so combining our available foods as to insure an adequate supply of the fat-soluble A, but none with respect to the water-soluble B in most parts of the world today. By far the greatest problems in dietetics today are involved in deciding how to group the natural foodstuffs so as to provide protein of high biological value, favorable inorganic content and adequate content of the fat-soluble A in the diet.



Patent Medicine Exploitation in China.—“Dollars *versus* Health,” is the title of an editorial in the September issue of the *Journal of the Outdoor Life*, which concerns the exploitation of China by the patent medicine interests, as advocated by the United States Department of Commerce in its special Consular Report No. 76.

At its annual meeting in May, the National Association for the Study and Prevention of Tuberculosis passed a resolution, a copy of which was sent to the secretary of the Department of Commerce, “urging that hereafter the influence of the United States Government should not be used in support of the patent medicine industry.”

Mr. E. E. Pratt, the chief of the Bureau of Foreign and Domestic Commerce of the Department replied to the resolution, in effect, “that so long as a trade is legal the business interests connected with it are entitled to such services as the Bureau is in position to give them.”

Mr. Pratt believes that the remedy for the situation lies in seeking legislation rather than in asking the Bureau to exercise authority not granted to it to discriminate between the manufacturers of different classes of products.

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Carbon Dioxide and Ventilation.—In an editorial in the *Boston Medical and Surgical*

Journal for December 6, 1917, the question of efficient ventilation is considered. It has been shown that carbon dioxide is not an absolute index of efficiency in ventilation. No deleterious effects have been experienced even when the CO₂ content of the air has been increased from 6 or 8 parts in 10,000, to 300 parts. The CO₂ content of the air is only an index of the amount of respiration the air in a particular place has undergone. The important factor in heating and ventilation is not related to the chemical purity of the air, but rather to the physical effect upon the skin and mucous membranes. Their normal physiologic action must not be diminished. When the humidity of a room can be maintained between 40 and 45, the temperature between 60 and 65° F., and the air velocity between 1 and 3 feet per second, the carbon dioxide and organic contamination will take care of themselves.

The problem of ventilation is more serious during the summer months than the winter months. During the winter, the difference between indoor and outdoor temperatures is great, and air interchange takes place more readily.

It is the belief of the author that natural ventilation is being discarded because it is inadequate, out of place at the present time, and wasteful of fuel. (M. P. H.)