

our observations in regard to rickets, having been able by means of irradiation to render "fats" active in preventing this disorder.² In our experiments various inert fluids were irradiated with the mercury vapor lamp for one hour at a distance of one foot, in order to ascertain whether by this means they could be endowed with antirachitic potency. It was found that cotton seed oil and linseed oil could be rendered specifically active by this means. After these oils had been thus irradiated they were able to protect rats from rickets when 0.1 cc. daily was fed in addition to the standard rickets-producing dietary (No. 84). The irradiated oils were able to store this factor for a considerable period. These experiments demonstrate the possibility of producing an antirachitic factor in vitro.

5 (2528)

Food accessory substances in bacterial growth. I. The influence of initial hydrogen ion concentration of media on the growth promoting effect of tomato extract.

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It seems from a review of the literature bearing on the question of the rôle of vitamins in bacterial growth that nobody has investigated the influence of Hydrogen ion concentration of media on the growth promoting effect of these factors. The purpose of the present work was to study this relationship.

As tomatoes have been shown by Thjötta and Avery¹ to contain food accessory substances for bacteria, the growth promoting effect of tomato extract adjusted to pH 7.0 upon the growth of *B. Shiga* in media of pH range 5.4-9.0 was investigated.

It was found² that this extract is not able to promote the growth of *B. Shiga* in broth at initial pH 5.2-6.2, that it has a moderate

² Steenbock, H., *Science*, Sept. 5, 1924, 224.

¹ Thjötta, Th., and Avery, O. Y., *Exp. Med.*, 1921, xxxiv, N-1.

² A detailed report will appear elsewhere.

growth accelerating effect on this microorganism at initial pH 6.6-7.8 and has the best effect when added to broth having a pH 8.2-8.6. Furthermore it may be pointed out that the best growth of *B. Shiga*, in the presence of tomato extract, occurs at a pH (8.2-8.6) which is by itself an unfavorable one for the multiplication of this microorganism in plain broth.

Before going any further with this investigation it was decided to determine the factor responsible for the growth promoting effect of tomato extract in the case of *B. Shiga*.

Thjötta and Avery,¹ who used the tomato extract for initiating the growth of Pfeiffer bacillus in blood free media, demonstrated that the poor nitrogen content of tomatoes cannot alone be responsible for the acceleration of bacterial growth.

It seemed necessary to determine whether the high sugar content might be the responsible factor, since it was found* that the extract used in these experiments contained 3.54 per cent of reducing substance expressed as glucose. But a quantitative titration of the growth promoting factor of this extract demonstrated that the latter had a pronounced effect when added in a dilution 1:100. Evidently, therefore, the growth promoting effect of tomato extract cannot be attributed to its sugar content since in a dilution of 1:100 there will be only 0.0354 per cent of sugar, or an amount that could not have by itself any appreciable effect on the growth of bacteria.

However, bone charcoal absorption experiments brought further information as regards the nature of the factor in question, as it can be definitely stated that the factor which shows the optimum growth promoting effect in *B. Shiga* cultures of pH 8.2-8.6 can be removed by bone charcoal.

To complete the experimental data, the influence of tomato extract on the growth of *B. Flexner*, *B. Abortus* (Bang), *Pneumococcus* type 2, *B. typhosus* and *streptococcus viridans* in media of various H-ion concentrations were studied.

These experiments show definitely that the tomato extract has no growth promoting effect in media of pH 5.2-6.2 and the best effect at pH 8.2-8.6.

There was a moderate growth promoting effect of this extract at the pH range 6.6-7.8 in case of *B. Flexner*, *B. typhosus* and

* I am indebted to Dr. Israel S. Kleiner for the quantitative estimation of sugar in tomato extract.

streptococcus viridans, while the growth of *Pneumococcus* type 2 started to show the acceleration only at pH 7.8 and that of *B. Abortus* at pH 7.0.

Since the observations described above demonstrate that the food accessory substances of tomato show their optimum growth accelerating effect on certain bacteria at Hydrogen ion concentrations which seem to be absolutely independent of the optimum pH for their growth in ordinary media, an explanation of this phenomenon was sought. See 18 (2541).

6 (2529)

The action of pepsin on insulin.

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Because of the practical advantages that would accrue from the oral administration of insulin in the treatment of diabetes, an exact knowledge of the mode of action of the digestive ferments upon it would be valuable. The various attempts made to procure physiological effects from insulin given by mouth have so far proved futile, and this failure has been ascribed to the destructive action of the gastro-intestinal ferments upon it. Recorded studies on the action of the individual proteolytic ferments on insulin agree that they 'destroy' insulin by proteolysis. These investigations assume that insulin is a 'protein' body, and that the loss of its physiological potentialities is the result of cleavage.

Certain considerations prompted a reexamination of this matter. In work recently reported,^{1, 2} it was found that trypsin does not actually destroy insulin, but that it merely renders it inactive

¹ Epstein, Albert A., and Rosenthal, Nathan, *J. Am. Med. Assn.*, 1924, lxxxii, 1990.

² Epstein, Albert A., Rosenthal, Nathan, and collaborators, *Am. J. Phys.*, 1924, lxx, 225 (in press).