with enzymes irradiated *in vitro*, reported the 'protective' action of certain substances contained in the medium. Similar observations on the protective action of certain substances against X-irradiation have been reported earlier[6-8] for viruses and enzymes.

In order to determine the possible association of different proteins and protein peptones with the enhanced resistance to X-rays, we added a series of these substances to samples of *T*1 before irradiation. The addition of different substances to the medium diminished the X-ray effect on the toxin in varying degrees.

In a number of experiments in which albumin was added, it could be observed that 10 per cent of albumin in the medium completely blocked the inactivating effect of 4 million r. on tetanus toxin (*T*1). Lower albumin content had a less noticeable protective action, and 0·1 per cent of albumin no longer had any demonstrable protective action against irradiation with 4 million r.

Protective action was noted after the addition of albumin, albumin peptone, rabbit serum, protamine, and globulin-peptone. No protective action was induced by the addition of globulin, casein, casein peptone, gelatine, edestin and irradiated toxin.

It is to be noted that substances, such as gelatine, which have a protective effect on certain other test objects such as sperm and hormones, exhibited no protective action on tetanus toxin in our experience.

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## Value of Adding Cotton-Seed, Okra and Fenugreek to Maize Flour

The association of maize-eating with pellagra and the prevalence of this disease in Egypt have, from time to time, suggested the replacement of maize by some other flour in bread-making; this being impracticable, attempts have been made to raise the nutritive value of maize by supplementing it with other flours. In Egypt, the problem has been unintentionally solved by peasants who have adopted the addition of either fenugreek (*Trigonella Fœnum-grœcum* L.), or okra (*Hibiscus esculentus* L.) to maize flour. The resulting bread was very satisfactory, at least so far as added fenugreek is concerned, and it compared well with wheaten bread.

It occurred, however, to those interested in cotton-seed by-products to recover the proteins of the seed after the extraction of the oil and to use the resulting flour as a supplement to maize. The cotton-seed flour is a fine product with yellow-green colour and no particular odour or taste. Its reaction is acid, and it contains 8·75 per cent of moisture, 5·91 per cent of fat, 51·35 per cent of raw proteins, 4·11 per cent of raw fibres, 8·62 per cent of ash and 21·26 per cent of nitrogen-free soluble substances.

*Supplementary value of the seed proteins.* Unlike wheat, maize flour does not possess the sticky gluten which characterizes wheat. The Egyptian peasant's idea in adding fenugreek to maize flour probably aims at producing a more or less cohesive mass with the help of fenugreek mucilage. When fenugreek is scarce or when it is expensive, the peasants employ instead okra, which contains a similar mucilage. Both fenugreek and okra are local products and are very cheap in comparison with the cotton-seed flour.

It therefore appeared desirable to compare the nutritive value of maize to which cotton-seed flour is added with maize plus fenugreek or okra. Young growing rats were used as experimental animals. Fed as a supplement to a maize diet adequate in all respects except for its protein component, cotton-seed flour at a 4 per cent level enhanced growth in a similar way to that induced by fenugreek or okra supplement at the same level. The increments obtained were 13, 34, 25 and 32 gm. for the basal diet, the basal plus cotton-seed flour, plus fenugreek and plus okra respectively. It might be argued that cotton-seed flour is not bitter, and that unlike fenugreek more of it can be added to maize with impunity. Such addition may increase the nutritive value of the bread and be a point in favour of the cotton-seed flour. It will be remembered, however, that while the bitter taste of fenugreek restricts its use, there are no such restrictions in the case of okra. It was therefore decided to make a fresh comparison with higher supplements of these seeds. Diets of the same compositions but containing 10 per cent of the different supplements were employed, using again young growing rats. When the level was raised to 10 per cent, it was found that the biggest increment was obtained in the case of the okra supplement (77 gm.), then came fenugreek (72 gm.), and finally the cotton-seed flour (48 gm.). If the different supplements were compared by dividing the weight increase by the protein content of the supplement in the different diets (proteins of cotton-seed flour, 51 per cent; fenugreek, 23 per cent; and okra, 18 per cent), then at both the 4 per cent and the 10 per cent levels the protein value of fenugreek is 2·5 times that of cotton-seed flour, while okra is 1·5 times that of fenugreek.

*Vitamin content of cotton-seed flour.* Biological experiments were made to test for the presence of vitamin $B_1$ and nicotinic acid, while vitamin A and its precursor carotene were determined spectrophotometrically. Cotton-seed flour contains an amount of vitamin $B_1$ equivalent to a fifth of that present in an equal weight of a sample of fresh 'Marmite'. The ether-soluble extract of the flour was examined spectrophotometrically and was found to contain no vitamin A, but it contained on the average 6·375 mgm. of carotenoids per cent. As regards nicotinic acid (anti-pellagra and anti-blacktongue factor), feeding experiments with dogs showed that it contained a small amount.

Cotton-seed flour is therefore inferior to fenugreek and okra in its protein value, and the vitamin content is not appreciable.

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