Binding Factor Found Connected with B_{12} Utilization

Unknown substance in gastric juice which combined with vitamin B_{12} to form high molecular weight complex seems to be connected with effective use of B_{12}

CHICAGO.—An adequate supply of vitamin B_{12} in the diet does not ensure its utilization by the organism. The problem of the absorption of B_{12} and its retention in the body is important, not only in human nutrition and disease treatment, but also in the feeding of poultry and livestock. An unknown binding substance which combines with B_{12} to form a high molecular weight, nondialysable complex is present in the gastric juice. Its function is not clear, but it seems to be connected in some way with the effective use of B_{12} by the animal.

The properties of the binding factor have been investigated by Bacon F. Chow, Johns Hopkins University School of Hygiene and Public Health, and were described by him here at the meeting of the Federation of American Societies for Experimental Biology held April 5 to 10.

In the gastric juice of humans suffering from pernicious anemia and other B_{12} deficiency diseases the substance is absent. The fact that the growth rate of hens improved more when B_{12} was injected rather than fed is another indication that absorption may be a limited factor in B_{12} nutrition.

The substance was isotopically tagged by adding cobalt-60-labeled B_{12} to gastric juice. The resulting complex was isolated by various separation techniques, the nonradioactive fractions being discarded in each step.

Molecular weight was determined by diffusion measurement to be approximately 500,000. Although soluble in 40% aqueous ethanol, the substance precipitated out of a 60% solution. Minimum solubility occurred at pH 3.5 to 4.0. Paper strip chromatography indicated that the material was composed of more than one fraction.

Binding power of gastric juice from pernicious anemia patients and from certain groups of aged patients compared unfavorably with that of healthy adults. Marian E. Swendseid, University of California, Los Angeles, found that in patients suffering from achlorhydria the amount of binding factor in the gastric juice was low, but duodenal secretions contained quantities comparable to those found in normal subjects. The procedure followed in these experiments consisted of testing simultaneous samples taken at 10 minute intervals from continuously aspirated duodenal and stomach secretions.

Absorption in Duodenum. Working with dogs, Harold L. Rosenthal, Tulane University school of medicine, presented data to show that B_{12} is absorbed primarily in the duodenum and not in the stomach.

The two organs were separated by construction at the proper point. B_{12} was placed in each section and blood samples were taken and assayed. The dogs having B_{12} placed in their duodenums showed an appreciable rise in serum B_{12} activity within four hours. The placing of B_{12} in the stomach had no effect on blood B_{12} content.

B_{12} content of eggs increases sooner and to a greater degree when hens receive the vitamin by injection rather than in their food. C. A. Denton, Bureau of Animal Industry, USDA, injected a group of hens daily at the rate of three micrograms of B_{12} per hen. In eight days the B_{12} content of the eggs laid by the hens increased from 0.08 to 1.25 microgram. The eggs from another group of hens receiving the same amount of B_{12}, but in their feed, increased in B_{12} content from 0.08 to 0.66 microgram per egg in 16 days. Higher levels of B_{12} administration gave corresponding results. Newly hatched chicks showed approximately the same activity as the eggs.

Egg Injection. J. T. Jackson, also from the Beltsville laboratories, described experiments dealing with the injection of B_{12} directly into the egg. Injection produced a pronounced growth rate increase in the chicks when hatched. By using cobalt-60–labeled B_{12} he determined that the injected material was still present in appreciable quantities in the chicks 12 weeks after hatching. The chicks had been fed on a low B_{12} diet and apparently there was no B_{12} uptake from the feed or from the intestinal flora during the first six weeks of growth.

On The Cover . . .

THE CLEAR PATH through the weeds which compete with the row of soybeans across the cover is a source of satisfaction to the farmer. Weeds to the left and right have grown freely. The effect of a herbicide is seen clearly in the open swath where chemical weed killer was applied. In the example shown, CMU [3-(*p*-chlorophenyl)-1,1-dimethyl urea], applied to sections of a soybean field at one-half pound per acre, has given a convincing demonstration of weed-killing power.

Today, three of our most important oil and fiber crops, soybeans, peanuts, and cotton, as well as others, have a brighter future in the fight against weeds than they had two years ago. While further research is needed in connection with soybeans to guide nation-wide use, great promise is being shown by chloro-IPC (isopropyl-N-chlorophenyl carbamate), CMU, and dinitro compounds.

This week, cotton farmers, as they begin to apply weed-killers, have a choice among these three outstanding new pre-emergence herbicides. In addition, the period of protection can be extended by the use of herbicidal oils which are effective as directed postemergence sprays. With peanuts, the dinitro compounds look most promising and, under certain conditions, the low volatile esters of 2,4-D may also prove very effective.

Only a few years ago, the technique of controlling weeds with chemical herbicides was so new as to be narrowly limited in use. Last year, an estimated quarter million acres of cotton were treated and an increase is anticipated this year. In the Southwest, thousands of acres of land are being cleared of mesquite by chemical weed-control methods. It has been stated that of the estimated $5 billion which weeds cost the nation last year, one half could have been saved through the application of present knowledge. The chemical herbicides are making their way.

Cover Photo Courtesy USDA