

rapid depletion of the liver glycogen occurs and definite histologic evidence of hepatic cell necrosis appears. The decrease in prothrombin, with or without a decrease in fibrinogen, may be correlated with the extent of liver damage. Any injury or destruction to megakaryocytes is reflected by a prompt proportionate decrease in the circulating blood platelets. Concomitant damage to the endothelial cells directly has not been demonstrated.

Whether hemorrhage will remain potential or become an actual fact in any given instance must depend upon the relative degree and interaction of the impairment which each of these 3 important coagulation factors suffers during a period of fever. The assurance of adequate glycogen storage in the liver should always be prerequisite to fever therapy, and a careful appraisal should be made of the megakaryocytic reserves in the bone marrow.

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Effect of Pectin Supplements on Avitaminosis A in Rats.*

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It is generally recognized that vitamin A is essential in preventing xerophthalmia and keratinization of the mucous epithelium of the body. This substance is also thought to play an important rôle in the synthesis of mucin by the body because a dehydration of the mucous membrane occurs as a result of avitaminosis A. Manville^{1, 2} has suggested that galacturonic acid plays a rôle in mucin formation. In view of the fact that the pectin molecule is composed of 8 molecules of galacturonic acid, it was thought that ingested pectin when fed in a vitamin A-free diet might retard the characteristic keratinization of the mucous epithelium. The object of this investigation was to determine whether or not pectin is effective in preventing or

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¹ Manville, I. A., Address delivered at 41st annual convention International Apple Assn., Boston, Mass., 1936.

² Manville, I. A., *Science*, 1937, **65**, 44.

delaying the development of the typical pathological symptoms which occur in avitaminosis A. The citrus pectin was "pure, 160 grade" obtained from the California Citrus Products Corporation, Ontario, California. It was free from vitamin A.

Four groups of female white rats were used in the experiment, the rats within each group being litter mates.

In Group 1, 6 rats were placed on a vitamin A-free diet, 6 rats on a vitamin A-free diet with the addition of 6% pectin, and 2 rats on a control diet containing an adequate amount of vitamin A.

In Group 2, 5 rats were placed on a vitamin A-free diet, with the addition of 3% pectin, 5 rats on a vitamin A-free diet, and 2 rats on the control diet.

In Group 3, four rats were placed on a vitamin A-free plus 12% pectin diet, and 2 rats were placed on the control diet. The 12% pectin diet was employed in order to observe the preventive action of pectin in regard to macroscopic manifestations of avitaminosis A. The diets employed were modifications of the Sherman and Munsell vitamin A-free diet.

The animals were observed carefully during the experiment, care being taken to keep the food and water fresh and amply supplied. The weights and macroscopic changes were recorded every other day, and upon later manifestations of avitaminosis A, daily observations were recorded.

The first part of the investigation consisted in making vaginal smears to detect the earliest possible indication of avitaminosis A. The method followed was that described by Mason and Ellison.³ At the onset of xerophthalmia in litter mates, the particular litter was killed and histological sections were made of the following tissues: eyelids, nares, vagina, liver, oesophagus, small intestine, and kidney.

The use of pectin as a supplement in a vitamin A-free diet did not delay the onset of xerophthalmia nor did it act in a curative capacity relative to this condition. In the liver, small intestine, kidney, and oesophagus there was no marked changes in avitaminosis A as compared to similar tissues from normal animals. In the vagina, nares, and eyelids there were marked changes in the mucosae and sub-mucous coat. The characteristic manifestations of avitaminosis A occurred in the rats on the vitamin A-free diet. However, in the rats receiving pectin these changes were not so marked.

Conclusion. Pectin appeared to be a beneficial supplement to a diet deficient in vitamin A, only insofar as pathological changes due to avitaminosis A in the vagina, nares, and eyelids are concerned.

³ Mason, K. E., and Ellison, E. T., *J. Nutr.*, 1935, **9**, 735.