of 2,4,5-T to determine its practical value as a sprout retardant on a commercial scale.

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A New Dietary Factor Related to Xanthine Oxidase[1]

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Measurements of the xanthine oxidase activity in rat livers by the method of Axelrod and Elvehjem (*1*) have demonstrated that, in order to obtain normal liver xanthine oxidase levels on diets containing adequate riboflavin, two other dietary factors are essential. These are: (1) adequate protein, as originally indicated by McQuarrie and Venosa (*5*), and (*2*) an unidentified factor found in raw cream and liver, both good sources of xanthine oxidase.

Rats are born without any detectable xanthine oxidase activity in the liver, even when their mothers are on an adequate diet and have normal levels of xanthine oxidase in their own livers at the time of birth. Small amounts appear in the liver during the nursing period, and when the rats are weaned at 21 days of age, the average activity is 720 units ($C_{mm}O_2$/gm of dry liver/hr). This is less than half of the 1,550 units of activity found as an average for mature rats maintained on an adequate diet. If such weanling rats are placed on a diet containing 21% purified casein or 8% casein plus 13% peanut protein or 21% egg albumin plus biotin, the liver xanthine oxidase remains at approximately the starting level for 6 weeks. The 21% casein diet is given in Table 1; all other diets mentioned are identical except for the specific differences noted. When weanling rats are fed Purina dog chow (21% protein), the liver xanthine oxidase is brought to a normal level of 1,535 units in two weeks. If the Wesson oil and Crisco in the 21% purified casein diet are replaced by an equal amount of raw cream (6%), the liver xanthine oxidase activity of weanling rats is increased to 1,300 units in two weeks. If 5% dried whole liver replaces an equal weight of casein in the diet, the liver xanthine oxidase remains low for two weeks but is increased significantly after four weeks. Similarly, feeding a 21% crude casein diet does not affect the liver xanthine oxidase activity within two weeks, but gives levels of 1,260 units after four weeks.

TABLE 1

Casein (GBI Vit. Test)	21%
Crisco	4
Wesson oil	2
Cod-liver oil	1
Salt mix (Phillips and Hart)	4
Glucose	68
Choline chloride	100 mg%
Nicotinic acid	2.5
Ca pantothenate	1.0
Riboflavin	0.4
Thiamine	0.4
Pyridoxine	0.4

These experiments demonstrate that a 21% protein diet is adequate in providing the necessary protein for normal xanthine oxidase levels in the liver if another dietary essential is also incorporated in the diet in adequate amounts. In the relative absence of this unknown factor the starting levels of liver xanthine oxidase remain unchanged. When limited amounts of the factor are supplied, as with the liver and crude casein diets, the xanthine oxidase activity remains low for a period of time and then increases rather suddenly. Feeding a relative abundance of the factor, as with Purina dog chow and, to a lesser extent, the raw cream diet, gives a rapid increase to normal levels.

Rats fed an 8% casein diet (81% glucose) have essentially no xanthine oxidase activity in the liver after four weeks whether they were started as weanlings or were first brought to normal levels of activity by being fed Purina dog chow for two weeks. Rats brought to a zero level of xanthine oxidase activity by feeding them an 8% casein diet remain at the zero level when 6% raw cream replaces the Crisco and Wesson oil in the low-protein diet. Hence, supplying the dietary factor found in raw cream is ineffective in the absence of an adequate protein intake. Such zero levels of xanthine oxidase activity can be restored to normal by feeding dog chow; feeding the 21% purified casein diet allows a slower increase in the activity, indicating the presence of some of the unidentified factor in the diet containing purified casein.

The above experiments were carried out with animals obtained from Albino Farms. Sprague-Dawley rats have a lower xanthine oxidase level in the liver at weaning, averaging 430 units. They show considerably less individual variation at this time, but require appreciably longer dietary periods to bring the activity in the liver to normal levels.

Supplementing the 21% purified casein diet with biotin, inositol, *p*-aminobenzoic acid, pteroylglutamic acid, rutin, ergostanyl acetate, adenine, *d*-ribose, and additional riboflavin did not give normal xanthine oxidase levels in the liver. It is suggested that this dietary factor necessary for normal liver xanthine oxidase activity may be related to the unidentified component of the prosthetic group of xanthine and aldehyde oxidases (*2*, *3*, *4*).

[1] Supported by a grant from the Nutrition Foundation, Inc.

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