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The Anti-Perosis Complex.*

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The rôle of manganese in preventing perosis in chicks was established¹ some time ago, and more recently it was demonstrated by Hogan, Richardson, and Patrick² that an organic factor is equally essential. Both are required to prevent the disease. This organic nutrient is present in a 95% alcohol extract of dried liver but it is absent from the water extract which was prepared after the alcohol extraction. Jukes^a identified choline with the antiperotic agent. Hogan, *et al.*,⁴ reported that choline protects chicks against perosis under certain conditions but in their experience it was not the only organic substance required. This report is to describe a type of perosis which results from a deficiency of a third, as yet unidentified, nutrient.

Day-old, single-comb White Leghorn chicks were used as experimental animals. The basal ration has the following composition: Casein 35, starch 31, cellulose 3, salt mixture⁵ 4, lard 17, acid hydrolyzed liver residue 10. Each 100 g of the ration was supplemented with 6000 1.U. of vitamin A, 850 I.U. vitamin D, 0.8 mg thiamin chloride, 1.6 mg riboflavin, 1.2 mg pyridoxine, 2.0 mg calcium pantothenate, 1.0 mg 2-methyl-1,4-naphthoquinone, and 0.8 mg of alpha tocopherol. The ration contained 0.025% manganese and the crude vitamin carriers were substituted for an equal weight of starch.

The water extract of dried beef liver, No. 4080, which was described by Hogan, *et al.*,⁴ was used as a source of the unrecognized vitamins required by the chick. This extract was treated with fuller's earth at a pH of 1.0, and the adsorbate was then eluted with 0.2 N ammonia. Choline was supplied to all chicks except those in

^{*} Contribution from the Department of Agricultural Chemistry of the Missouri Agricultural Experiment Station. Journal Series No. 780.

¹ Wilgus, H. S., Jr., Norris, L. C., and Heuser, G. F., J. Nutrition, 1937, **14**, 155. ² Hogan, A. G., Richardson, L. R., and Patrick, H., Proc. Am. Inst. Nutr., p. 12; J. Nutrition, 1940, **19**.

³ Jukes, T. H., J. Nutrition, 1940, 20, 445.

⁴ Hogan, A. G., Richardson, L. R., Patrick, H., and Kempster, H. L., J. Nutrition, 1941, 21, 327.

⁵ Hubbell, R. R., Mendel, L. B., and Wakeman, A. J., J. Nutrition, 1937, 14, 273.

The other supplements were added to the basal ration as Group I. follows:

Group I and II, water extract of liver, 6%.

Group III, filtrate after fuller's earth adsorption of the water extract of liver at pH 1.0, 6%.

Group IV, inositol 100 mg, nicotinic acid 10 mg, and p-aminobenzoic acid 30 mg, per 100 g of the basal ration.

Group V, fuller's earth adsorbate of the water extract of liver at pH of 1.0, 6%.

Group VI, a 0.2 N ammonia eluate of the fuller's earth adsorbate, 1%.

TABLE I.

These data are summarized in Table I.

Effect of Choline and of Liver Extract on Perosis.*						
Group	Supplement		Perosis			
		Choline, %	No. of chicks	Incidence %	e, Indext	Mortality, <u>%</u>
I	Water extract of liver	0.0	11	100	33.0	0.0
II	,, , , ,,,,,	0.1-0.4	55	3.6	1.0	2.0
111	Filtrate after fuller's earth adsorption	0.4 0.4-0.6‡	12 12	91.6 83.3	30.0 25.9	19.6 41.6
IV	Inositol, nicotinic acid and p-aminobenzoic acid	0.6	6	100.0	34. 0	0.0
v	Fuller's earth adsorbate at pH of 1.0	0.1-0.6 0.4‡	55 9	5.4 11.1	$\begin{array}{c} 1.8 \\ 2.1 \end{array}$	0.0 11.1
VI	0.2 N ammonia eluate of fuller's earth adsorbate	0.4 0.4‡	$\frac{22}{5}$	8.6 0.0	1.6 0.0	4.3 20.0

*Experimental period 6 weeks.

*Calculated by the method of Wilgus, Norris and Heuser.6 *An equal quantity of gelatin was substituted for the acid hydrolyzed liver residue and each chick received 3 γ of biotin per day, SMA Concentrate 200.

Every chick which received the water extract of liver without choline (Group I) developed a severe perosis. The perosis which developed on this type of ration was prevented almost completely by including 0.1 to 0.4% of choline in the diet (Group II). When the water extract of liver was replaced by the filtrate after fuller's earth adsorption (Group III), 0.4 to 0.6% of choline did not prevent the occurrence of severe perosis. The addition of inositol, nicotinic acid, and p-aminobenzoic acid (Group IV) or 3 gamma of biotin per chick per day (Group IIIa) were ineffective.

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⁶ Wilgus, H. S., Jr., Norris, L. C., and Heuser, G. F., Poultry Sci., 1937, 16, 232.

These data show that at least one nutrient is required, in addition to choline and manganese, to prevent perosis in chicks. Furthermore, this substance is not identical with any of the recognized vitamins. The fuller's earth adsorbate (Group V) and a 0.2 N ammonia eluate of the fuller's earth adsorbate (Group VI) are fair sources of the nutrient.

The perosis due to a deficiency of the unidentified factor is similar to that produced by a deficiency of manganese or choline, but is usually less severe. If it were possible to supply all other essential unrecognized vitamins in a concentrated form, the chicks probably would grow faster, and presumably they would develop more severe symptoms.

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Relationship Between Anesthetic Potency and Physical Properties.*

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A new series of cyclopropyl aliphatic ethers has been synthesized in this laboratory. The first two members of this series, cyclopropyl methyl ether (cyprome ether) and cyclopropyl ethyl ether (cypreth ether) have been shown to be useful anesthetics.^{1, 2, 8} In comparative studies with these new agents it became necessary to study the physical properties of these compounds to determine their value in predicting anesthetic potency. The literature available on the oil/water coefficients of the generally used anesthetics is confusing and data are not concordant. The authors believe that this is due to: first, the technical difficulties inherent to the determination; second,

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¹ Krantz, J. C., Jr., Carr, C. J., Forman, S. E., and Evans, W. E., Jr., J. Pharm. and Exp. Therap., 1940, 96, 207.

² Black, C., Shannon, G. E., and Krantz, J. C., Jr., Anesthesiology, 1940, 1, 274. ⁸ Krantz, J. C., Jr., Carr, C. J., Forman, S. E., Evans, W. E., Jr., and Wollenweber, H., J. Pharm. and Exp. Therap., 1941, 72, 233.