

a somewhat more localized swelling with occasional necrotic areas. Both lesions subsided in 4 to 6 days. It was noted that almost invariably the treated animals had a more severe bacteremia, particularly in those which received the larger doses of radiation. In these animals the more severe bacteremia was paralleled by a greater mortality at an earlier date, death usually occurring 4 to 6 days after injection.

Summary. Roentgen ray therapy applied one-half hour after inoculation is ineffective in preventing bacteremia or in favorably influencing the outcome in rabbits injected intradermally with pneumococcus Type I. When larger therapeutic doses are employed roentgen rays have apparently a deleterious effect as evidenced by a more pronounced bacteremia and greater mortality.

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Vitamin B₆ Deficiency in Chicks.

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Among the members of the vitamin G complex, riboflavin¹ and pantothenic acid² are known to have a marked effect in promoting growth in chicks, while nicotinic acid has not been demonstrated to be needed by this species. Several recent reports^{3, 4, 5} have indicated that one of more water-soluble factors, unidentified with other members of the vitamin G complex, are needed by chickens. Carter and O'Brien⁶ have reported that vitamin B₆ promoted growth slightly in chicks fed a purified diet. The growth rate obtained was very low.

Previous attempts in this laboratory to investigate the vitamin B₆ requirement of the chick were hampered by the fact that a factor or

¹ Lepkovsky, S., and Jukes, T. H., *Science*, 1935, **82**, 326.

² Jukes, T. H., *J. Biol. Chem.*, 1939, **129**, 225.

³ Lepkovsky, S., and Jukes, T. H., *Proc. Am. Soc. Biol. Chem., J. Biol. Chem.*, 1937, **119**, lx.

⁴ Jukes, T. H., and Babcock, S. H., Jr., *J. Biol. Chem.*, 1938, **125**, 169.

⁵ Stokstad, E. L. R., and Manning, P. D. V., *J. Biol. Chem.*, 1938, **125**, 687; Lepkovsky, S., Taylor, L. W., Jukes, T. H., and Almquist, H. J., *Hilgardia*, 1938, **11**, 559; Bauernfeind, J. C., Schumacher, A. E., Hodson, A. Z., Norris, L. C., and Heuser, G. F., *Proc. Soc. Exp. Biol. and Med.*, 1938, **39**, 108.

⁶ Carter, C. W., and O'Brien, J. R., *Proc. Seventh World's Poultry Congress*, 1939, p. 126.

factors of an unknown nature, distinct from pantothenic acid (chick anti-dermatitis factor), sharply limited the growth of chicks on purified diets. Crude concentrates of vitamin B₆ were ineffective, but growth was promoted on some diets by fat-extracted wheat germ³ and on other diets⁴ by a water extract of alfalfa meal. Subsequently it was observed that the unknown factor or factors partially escaped precipitation with phosphotungstic acid. It had been previously observed⁷ that the filtrate (chick-anti-dermatitis) factor also was not precipitated by phosphotungstic acid. These observations encouraged a fresh attempt to produce vitamin B₆ deficiency in chicks.

The following basal diet was used (diet 190) :

Glucose (cerealose)	63	g
Sardine meal, washed with water	20	"
Washed casein	5	"
Lard	5	"
Salt mixture	4	"
Fish oil blend, 3000 U.S.P. units of vitamin A and 400 A.O.A.C. units of vitamin D per gram	0.3	"
Yeast extract, treated with phosphotungstic acid	2	cc
Nicotinic acid*	1	mg
Riboflavin*	0.4	"
Thiamin*	0.2	"
Hexane extract of alfalfa meal, equivalent to 1 g of alfalfa meal, evaporated on the diet.		

The salt mixture consisted of bone ash, 39 parts; calcium carbonate, 20; iodized salt, 20; MgSO₄, 7H₂O, 8.8; KH₂PO₄, 7.5; ferric citrate, 3.5; MnSO₄, 1; CuCO₃, 0.1; ZnCO₃, 0.1. The yeast preparation, which had been treated twice with a large excess of phosphotungstic acid, contained 100 chick units⁷ of filtrate factor (pantothenic acid) per cc. The chicks received 0.1 cc of shark liver oil, containing 14,500 U.S.P. units of vitamin A per gram, and 0.3 cc of wheat germ oil, by pipette, once weekly.

Single-comb White Leghorn chicks were kept on a regular chick-starting mash for 3 days and then placed on the experimental diets. Group 1 received basal diet 190 and Group 2 received a diet consisting of 100 g of diet 190 *plus* 0.3 mg of synthetic vitamin B₆ hydrochloride.*⁸ Eight chicks were used in each group. The growth curves are shown in Fig. 1.

Nervous symptoms, consisting of various convulsive movements, were observed in 50% of the birds on the basal diet. Sometimes a bird would run about the cage in a jerky and abnormal manner. No symptoms were observed in the group receiving supplementary

⁷ Jukes, T. H., *J. Biol. Chem.*, 1937, **117**, 11.

* Generously furnished by Merek and Co., Inc., Rahway, New Jersey, through the kindness of Dr. John C. Keresztesy and Dr. Randolph T. Major.

⁸ Harris, S. A., and Folkers, K., *J. Am. Chem. Soc.*, 1939, **61**, 1245.

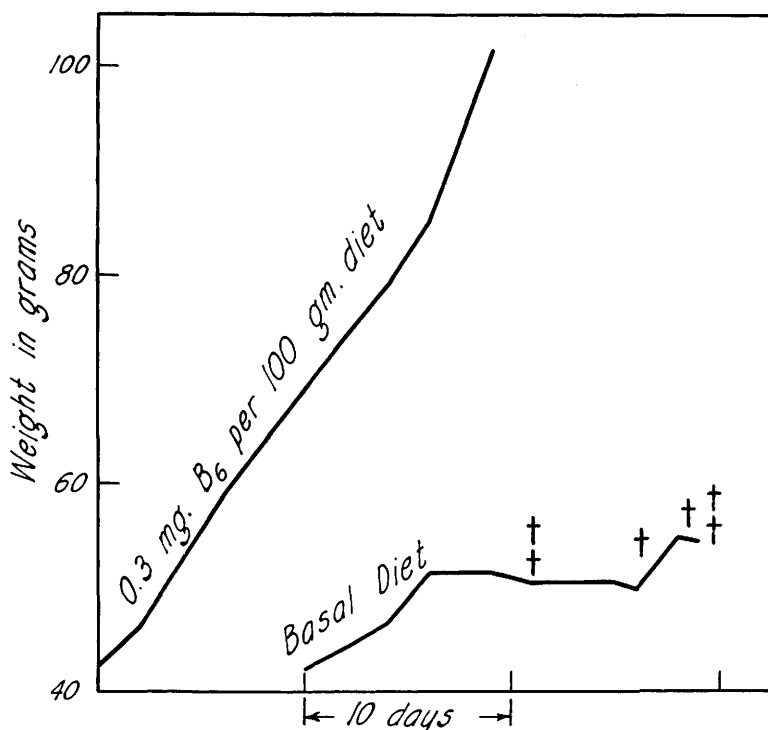


FIG. 1.

Growth curves of chicks receiving synthetic vitamin B₆ compared with chicks on a basal diet deficient in the vitamin. Each cross above the curve indicates the death of a chick.

vitamin B₆. The average daily food consumption per bird was 3.8 g for Group 1 and 6.9 g for Group 2. The efficiency of gain was 0.12 g per gram of food consumed by Group 1 and 0.35 g for Group 2. Differential blood-cell counts were made on the 17th day of the experimental period by Dr. N. M. Twisselmann of the Division of Veterinary Science, but no departures from the normal range were found in either group.

Summary. The symptoms of vitamin B₆ (2-methyl, 3-hydroxy, 4,5-di-(hydroxymethyl) pyridine) deficiency in chicks consist of slow growth, depressed appetite and inefficient utilization of food, followed in some cases by spasmodic convulsions and death. The symptoms were prevented by adding synthetic vitamin B₆ to the diet.