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Requirement of Potassium by the Chick.*

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In the search for a new chick growth factor present in rice bran and wheat bran, it was found that the beneficial effect of adding these substances to a rice-fish-meal basal diet was due, in part, to their high potassium content. Since no data could be traced in the literature on the potassium requirement of poultry, it seemed desirable to report certain results obtained in these studies. The capacity of rubidium to replace potassium was also investigated.

Experimental. Single Comb White Leghorn chicks procured from the University flock were reared on the normal stock ration until placed in experimental groups. They were kept in electrically heated brooders provided with wire screen floors. Ordinary tap water was supplied throughout the experiments.

The basal diet contained per 100 g, rice, polished, 71.0 g; fishmeal, water-washed and ether-extracted, 20.0 g; soybean oil, 3.0 g; vitamins A and D carrying oil, 1.0 g; hexane extract of alfalfa equivalent to 2.0 g of alfalfa. 2.2 g of minerals were added as a salt mixture containing sodium chloride, 46.0, calcium carbonate, 46.0, magnesium sulfate, 2.5, manganese sulfate, 2.4, ferrous sulfate, 1.25, aluminum sulfate, 1.25, zinc sulfate, 0.23, copper sulfate, 0.20, potassium iodide, 0.03, and cobalt acetate, 0.02 parts. This diet was supplemented with synthetic vitamins as follows: riboflavin, 1.0 mg; thiamin, 1.0 mg; nicotinic acid, 0.5 mg. 6.0 g of an extract of wheat bran from which the potassium was removed supplied pyridoxin and factor U.

The wheat bran extract was prepared by extracting 5 times with warm (50°C) 60-70% methanol (by volume). The combined extracts were concentrated under reduced pressure. Each pound of the final extract was derived from 6 pounds of bran. The chick antidermatitis vitamin (pantothenic acid) was supplied as 3.0 g of a concentrate prepared from whey from which the potassium was removed. It was prepared from the wash liquor remaining after the removal of lactose from whey, as described by Lepkovsky, Tay-

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lor, Jukes and Almquist.[1] The wheat bran extract and the chick antidermatitis vitamin concentrate were treated for the removal of potassium by the procedure of Miller.[2] Factor U was prepared by eluting with barium hydroxide a fullers' earth adsorbate prepared from the wheat bran extract. The charcoal eluate of the milk sugar concentrate was prepared by the method of Woolley, Waisman, Mickelsen and Elvehjem.[3]

Potassium and rubidium were added in the form of the chloride. The total potassium content of basal diets was determined by analysis.

Effect of Potassium on Growth and Mortality of Chicks. The results of one of the tests on the ability of chicks to grow and survive on different levels of potassium are given in Table I.

It is evident that under the conditions studied, more than 0.13% of dietary potassium is essential for good growth and survival.

Replacement of Potassium by Rubidium. The ability of rubidium to replace potassium was determined with the same basal diet with the following modifications. Wheat bran extract was eliminated and pyridoxin was supplied as 0.3 mg synthetic pyridoxin. Factor

TABLE I.
Weight and Mortality of Chicks 35 Days on Diets Supplemented with Different Levels of Potassium.*

Total potassium in diet, %	Avg wt, g	Mortality, %
0.076	139	71.5
0.130	272	43.0
0.230	280	14.5
0.400	286	0.0

*Each group began with 14 10-day-old chicks whose average weight was 62 g.

TABLE II.
Effect of Rubidium on Potassium Deficiency.

Potassium and rubidium in diet %	Chicks per group	On 15th day on test diet*			On 28th day on test diets, No. chicks dead
		No. chicks dead	Avg wt in g	Standard error	
.072 K	10	1	48	1.8	5
.072 K + .072 Rb	10	0	52	1.4	4
.072 K + .28 Rb	10	0	55	2.8	5
.172 K	14	0	73	4.5	0

*The average weight of the chicks on the first day on the test diets was 35 g. They were placed on the experimental diets at the time of hatching.

1 Lepkovsky, S., Taylor, L. W., Jukes, T. H., and Almquist, H. J., *Hilgardia*, **11**, 559.

2 Miller, H. G., *J. B. C.*, 1923, **55**, 61.

3 Woolley, D. W., Waisman, H. A., Mickelsen, O., and Elvehjem, C. A., *J. B. C.*, **1938, 125, 715.**

U was supplied as 0.7 g of a fullers' earth eluate of the wheat bran extract. Pantothenic acid was supplied as 0.1 g of a charcoal eluate of the milk sugar concentrate. The results are shown in Table II. Rubidium exerted a slight and only temporary alleviating effect on potassium deficiency.

Discussion. A comparison of the potassium requirement of the rat, as reported in the literature, and that of the chick, as reported in this paper, indicates a greater sensitivity on the part of the latter to potassium deficiency. When rats were fed 0.037% potassium[2] and 0.033% potassium[4] they survived at least 112 days and 220 days respectively. The chicks, on the other hand, were all dead within 40 days when fed 0.076% potassium. At the same time chicks receiving adequate levels of potassium grew fairly well and were in good condition. Growth, however, was below that obtainable on our stock diet.

Summary. 1. At least 0.17 g of potassium per 100 g of diet was found necessary to secure approximately maximal growth of chicks under the conditions of these experiments. 2. More than 0.13 g of potassium per 100 g of diet was necessary to prevent heavy mortality. 3. Rubidium had a slight and only temporary alleviating effect on potassium deficiency.

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Formation of Pressor Amines in the Kidney.

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Holtz[1, 2] found that renal cortical extracts of different species were able to transform *l*-histidine, *l*-tyrosine and *l*-dopa (*l*-dihydroxyphenylalanine) into their corresponding amines. The presence of the amines was demonstrated by their effect on the blood pressure of a test cat. The action of the enzymes responsible for this decarboxylation could be demonstrated only under anaerobic conditions. Bing[3] showed that this process could also occur in the isolated kidney

[4] Osborne, T. B., and Mendel, L. B., *J. B. C.*, 1918, **34**, 131.

[1] Holtz, P., *Klin. Woch.*, 1937, **16**, 1561.

[2] Holtz, P., and Heise, R., *Arch. Exp. Path. und Pharm.*, 1939, **191**, 87.

[3] Bing, R. J., *Am. J. Physiol.*, 1941, March.