17092. Importance of Potassium and Magnesium in Nutrition of the Guinea Pig.*

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Several extensive studies have been made to devise a purified ration which will give growth in guinea pigs equivalent to that obtained with commercial rations (about 7 g/day). Booth *et al.*[1] recently found that powdered gum arabic, when added to a purified synthetic ration at a level of 15%, increased the daily growth from 1.8 to 5.1 g. When in addition to gum arabic the ash from alfalfa leaf meal was added to the ration at a level equivalent to 25% of alfalfa, nearly "normal" growth was obtained. The particular constituents of alfalfa ash responsible for the activity observed were not identified. In this paper we report experiments which were conducted to determine the active components of alfalfa ash.

Experimental. The experimental procedure was similar to that of Booth *et al.*[1] The synthetic basal ration consisted of: sucrose 60.9%, casein (vitamin-free) 30%, salts IV[2] 4%, fortified soybean oil 4%, sucrose mixture containing B vitamins 0.8%, and choline 0.3%. The fortified soybean oil supplied 1.2 mg of β-carotene, 12 mg of α-tocopherol, 8 μg of calciferol and 0.2 mg of menadione per 100 grams of ration. The vitamin B mixture supplied 1 mg of thiamine hydrochloride, 1.4 mg riboflavin, 1 mg pyridoxine, 3 mg calcium pantothenate, 200 mg inositol, 10 mg niacin, 10 mg p-aminobenzoic acid, 0.04 mg biotin and 0.3 mg folic acid per 100 grams of ration. Vitamin C dissolved in sucrose solution was fed with individual pipettes at a level of about 25 mg every other day. Gum arabic was used at a level of 15%. The gum and the different inorganic compounds tested were added to the ration in place of an equal amount of sucrose.

Results. Since it seemed possible that the beneficial effect of alfalfa ash observed by Booth *et al.* was due to its alkalinity, certain alkaline compounds were used in place of the ash. It was noticed in preliminary experiments that the addition of potassium acetate or magnesium oxide to the basal ration containing gum arabic distinctly improved the growth. Very good growth was obtained with mixtures of these two minerals. The results of an experiment in which different levels of potassium acetate and magnesium oxide were fed are given in Table I. The best growth was obtained when 2.5% potassium acetate and 0.5% magnesium oxide, *i.e.*, 1.0% K and 0.3% Mg, were added to the ration. The amounts of K and Mg in the basal ration supplied by salts IV are 0.56% and 0.04%, respectively.

Table II shows the results of experiments in which other compounds of K and Mg were compared with potassium acetate and magnesium oxide. The amount of potassium acetate used in the rations given in Table II was 2.5% and an equivalent amount of potassium was given as potassium bicarbonate and phosphate. Magnesium oxide was used at a level of 0.5% and an equivalent amount of magnesium was included in the other magnesium compounds. The data show that the growth of the animals receiving potassium acetate and magnesium oxide but no gum arabic was rather poor. However, growth equal to that of animals on the stock ration was obtained, when these minerals were fed in the presence of gum arabic. An experi-

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1 Booth, A. N., Elvehjem, C. A., and Hart, E. B., *J. Nutrition*, 1949, **37**, 263.

2 Hegsted, D. M., Mills, R. C., Elvehjem, C. A., and Hart, E. B., *J. Biol. Chem.*, 1941, **138**, 459.

TABLE I.
Effect of Different Amounts of Potassium Acetate and Magnesium Oxide on Growth of Guinea Pigs Receiving a Purified Basal Ration Plus 15% Gum Arabic.

Potassium acetate, %	Magnesium oxide, %	No. of animals	Avg gain in wt during 6 wks, g/day
None	None	4	5.2
2.5	0.25	4	5.3
2.5	0.5	5	7.2
2.5	1.0	4	5.1
5.0	1.0	4	6.2
1.25	0.5	3	6.2

TABLE II.
Growth of Guinea Pigs on Different Rations.

Ration	No. of animals	Avg gain in wt during 6 wks, g/day
Basal + gum arabic	4	5.2
Basal + potassium acetate + magnesium oxide	4	2.6
Basal + gum arabic + potassium acetate + magnesium oxide	13	6.4
Basal + gum arabic + potassium acetate + magnesium carbonate	4	6.2
Basal + gum arabic + potassium acetate + magnesium acetate	4	7.1
Basal + gum arabic + potassium acetate + magnesium sulfate	4	5.4
Basal + gum arabic + potassium bicarbonate + magnesium oxide	4	5.2
Basal + gum arabic + potassium dihydrogen phosphate + magnesium oxide	3	5.5
Rockland stock diet	9	6.6

ment lasting 11 weeks showed that the "normal" growth on the ration containing potassium acetate and magnesium oxide continued at least this length of time. Of the other salts tested magnesium acetate showed a very good growth response. Further experiments with larger numbers of animals are required, however, to show the comparative values of different salts.

Since potassium acetate and magnesium oxide were not active in the absence of the gum arabic, it appears that they may produce conditions in the tract which allow the presence of an intestinal flora more beneficial to the host. The assumption that they may raise the pH in the cecum is probably not correct because it was found that the pH of the cecum was the same (average 6.9) irrespective of whether or not the diet contained added K and Mg.

Summary. A normal rate of growth for guinea pigs, comparable with the growth on commercial rations, was obtained when potassium acetate and magnesium oxide were added to a purified basal ration containing all of the known nutrients (except vitamin B_{12}) and 15% gum arabic. The best results were obtained with 2.5% potassium acetate and 0.5% magnesium oxide.

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