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Effect of Zinc upon Growth and Incidence of Perosis in Turkey Poults.* (23991)

F. H. KRATZER, PRAN VOHRA, JOHN B. ALLRED AND P. N. DAVIS
Department of Poultry Husbandry, University of California, Davis

Todd *et al.*(1) and Stirn *et al.*(2) reported that zinc is indispensable in the nutrition of the rat. Follis *et al.*(3) studied the histology of zinc deficient rats and noted a parakeratosis as a characteristic symptom. Tucker and Salmon(4) reported that a parakeratosis syndrome was noted in swine on rations containing 34 to 44 ppm of zinc. The incidence was increased by increased levels of calcium and/or phosphorus. The syndrome was prevented and growth improved by supplementing the ration with zinc. Zinc was also found to be effective in preventing the parakeratosis at lower levels of calcium in practical rations by Luecke, *et al.*(5) and purified protein (Drackett) diets by Conrad and Beeson(6). Morrison *et al.*(7) obtained no growth response to zinc with chicks fed a purified ration containing an isolated soybean protein (Drackett C-1). Mehring *et al.*(8) also failed to observe any increased growth by addition of zinc to a practical type ration for chicks. O'Dell and Savage(9) observed increased growth of chicks fed a Drackett protein basal ration with relatively high levels of calcium and phosphorus when zinc carbonate was added. Norris *et al.*(10) also obtained a slight growth response in chicks with a similar type ration, except that lower calcium and phosphorus levels were used and concluded that the requirement of chicks for zinc was in the order of 20 to 25 ppm. Hunt *et al.*(11) and Butters and Scott(12) noted an enlarged hock condition in turkey poults fed purified rations with isolated soybean protein (Drackett 220 or C-1) as source of protein. It could be prevented by substituting soybean oil meal for Drackett protein or by adding soybean oil meal ash to purified rations(12). Slinger *et al.*(13) noted no improvement in growth of poults by addition of zinc to a practical ration. Supplee *et al.*(14) observed that zinc and potassium additions to a purified ration containing Drackett protein were effective in reducing the incidence of the enlarged hock disorder and in improving growth. The pres-

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TABLE I. Effect of Zinc, Potassium, and Soybean Oil Meal on Growth and Perosis in Poults.

Supplement	Level of added zinc, ppm	Avg. gain in g and (perosis score) Exp. 1	Exp. 2	Exp. 3	Exp. 4
None	0	(3.0)323; (3.5)277	(3.4)269	(2.4)189	(2.6)258
$ZnCl_2$	4.8			(2.2)230	
	9.6			(2.2)230	
	19.2			(1.7)271	
	38.4			(1.5)279	
	48.0	(1.4)423	(.8)366		
	76.8			(1.0)269	
	96.0		(.6)408		(.4)297
	153.6			(1.1)252	
$ZnCl_2$ + 0.3% KCl	48	(1.4)382; (.9)366	(1.1)379		
ZnO	38			(1.4)291	
Soybean oil meal (60%)		(1.4)425			
Duration of trial, days		22	21	18	17

ent work was carried out to study the effect of zinc and potassium on poults fed a purified ration containing Drackett protein. Zinc was found to be very effective in promoting growth and reducing the incidence of perosis.

Methods. The basal ration contained the following: isolated soybean protein (Drackett C-1), 30 g; cellulose (Solka-Floc), 5 g; soybean oil, 3.5 g; dicalcium phosphate ($CaHPO_4$), 3 g; mineral mixture, 2.563 g; calcium carbonate, 2.5 g; vitamin mixture(15), 2 g; choline chloride (25%), 1 g; DL-methionine, 0.45 g; Vit. E concentrate (20,000 IU/#), 0.2 g; Vit. D_3 concentrate (1,500 ICU/g), 0.1 g; inositol, 0.1 g; Vit. A concentrate (20,000 IU/g), 0.05 g; aureomycin, 0.01 g; niacin, 2 mg; folic acid, 0.5 mg; biotin, 0.04 mg; Vit. B_{12}, 1 μg; and pearl corn starch to equal 100 g. The mineral mixture supplied the following/100 g of diet: NaCl, 1 g; $MnSO_4$ $1H_2O$, 0.03 g; $Na_2SiO_3 9H_2O$, 0.115 g; $FeSO_4$ $7H_2O$, 0.07 g; $CuSO_4 5H_2O$, 0.008 g; $Co(AC_2)$ $4H_2O$, 0.002 g; KI, 0.001 g; $Al_2(SO_4)_3 18H_2O$ 0.025 g; $MgSO_4 7H_2O$, 0.63 g; KCl, 0.3 g; K_2HPO_4, 0.381 g; and $(NH_4)_6Mo_7O_{24}4H_2O$, 0.001 g. The basal ration was analyzed by the method of Rush and Yoe(16) and contained 26 ppm of zinc. It contained 1.88% calcium and 0.75% phosphorus by calculation from the minerals. Broad Breasted Bronze poults were fed the basal ration 4 days before being segregated into groups of 10 birds each to be fed the experimental rations. They were housed in electrically heated batteries with raised wire floors. Feed and water were supplied *ad libitum*. Trace amounts of zinc as furnished by galvanized feeders and watering troughs were not taken into consideration. The birds were weighed twice weekly and the trials were continued 17 to 22 days (Table I).

Results. Poults fed the basal ration developed a leg abnormality, characterized in its most severe state by a swelling and flattening of the hock joint and slipping of the Achilles tendon from the condyle (Fig. 1). A shortening and bending of the tarsometatarsus and a bending of the tibiotarsus have been observed. The condition is similar to perosis, and in the absence of histological examination to characterize it further, we will refer to it as perosis. In contrast to Butters and Scott(12), no reduction in bone ash has been observed in our studies. The incidence and degree of perosis were markedly reduced as zinc was added to the ration (Table I). Growth was also greatly improved by addition of zinc to the ration, and in Exp. 3 about 38 ppm of zinc in addition to the amount already present in the ration were required to give optimum growth. Statistically significant growth increases were noted in both males and females. Zinc chloride and zinc oxide appear equally effective in promoting growth and preventing perosis. Potassium chloride in addition to zinc was not more effective than zinc alone. Soybean oil meal, replacing Drackett protein, was effective in increasing growth and decreased perosis

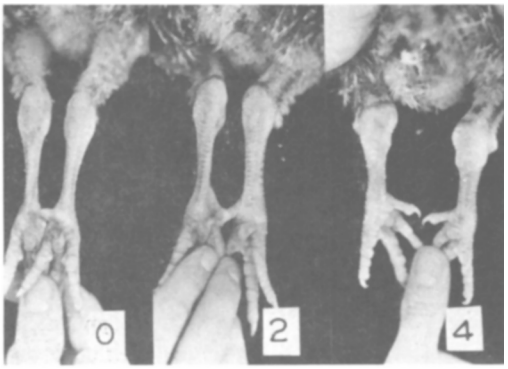

FIG. 1. Legs of turkey poults illustrating normal (0), intermediate (2) and severe (4) perosis caused by feeding ration deficient in zinc for 21 days.

about as much as zinc. The meal was analyzed and contained about 66 ppm of zinc.

Discussion. The observation of perosis or leg weakness in turkey poults fed a ration containing Drackett C-1 protein is similar to that reported by Hunt *et al.*(11) and Butters and Scott(12). The abnormality was also prevented by replacing the Drackett protein with soybean oil meal as reported by these workers. Supplee *et al.*(14) noted the same hock condition and were able to prevent it with potassium and zinc supplements. Our experiments have shown that zinc is the element which is effective in prevention of perosis and promotion of growth. The levels of calcium and phosphorus in the ration no doubt influence the response obtained to zinc.

The response to soybean oil meal could be explained on the basis of the zinc content (66 ppm *vs.* 24 ppm in Drackett protein). However, it is not certain whether association of hock disorder with the use of Drackett protein is due to low zinc content entirely or whether there are other factors involved which may influence its availability or utilization.

Turkey poults appear to resemble rats(1,2, 3) and swine(4,5) in having a definite requirement for zinc. The mechanism by which zinc may function in the metabolism of the poult has not been determined.

Summary. Turkey poults fed a purified ration containing an isolated soybean protein (Drackett C-1) developed perosis. Addition of zinc to the ration improved growth and markedly reduced the incidence and severity of the perotic condition. Approximately 40 ppm of zinc, in addition to the 26 ppm contained in the basal ration, were required for optimum growth.

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