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EFFECTS OF CELLULASE SUPPLEMENTATION AND WHEAT BRAN ON MINERAL UTILIZATION IN BROILERS

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A number of reports have indicated that mineral absorption is decreased by fiber. While it is undoubtedly true that phytic acid impairs calcium absorption (McCance, 1942), it now seems distinctly possible that fiber itself, independent of phytate, interferes with mineral absorption and metabolism (Cunnings, 1978). Phytate is digestible (Sullivan et al., 1966) and like other digestible chelators would ultimately liberate bound metals as digestion proceeds. On the other hand, metals bound by the indigestible residue, mainly fiber, remain unavailable for absorption. Although fiber may be attacked by the bacteria of the large gut with release of metals, absorption can no longer occur in this region and the metals will be lost in the feces. Consequently, it is the fiber content of feedstuffs that largely determines availability of bivalent metals. Phytate would be important only to the extent that it escapes digestion.

In this experiment, 3-week-old broiler type chicks were assigned to 24 groups of 10 chicks each for two replicates of 12 treatments. A completely randomized experiment with a 4 x 2 factorial arrangement involved feeding 0, 10 or 20% wheat bran or 20% wheat bran plus cellulase. The birds were housed in electrically heated batteries with raised wire floors. Feed and water were supplied ad libitum. The wheat bran was defatted and the cellulase (imported from Boerhinger, Mannheim, Gmn H. W. Germany) was mixed at .008% in the total diet. The enzyme supplementation to the diet was as a dry preparation.

After a 5-week experimental period, the four diets with a chromium marker were fed for 5 hours after which the chicks were fasted for 14 hours. Feces were collected for 8 hours after withdrawal of the diets (13 hours after feed was offered). The relative amounts of elements excreted within 13 hours after the diet was offered were determined.

The feces samples were immediately weighed, placed in aluminum pans and freeze dried. The dried samples were ground using a 1 mm mesh Udy mill. Samples of dried feed and feces were stored in air-tight glass bottles at 0 C until analyzed. The contents of calcium, zinc and copper were measured by atomic absorption spectrophotometry and phosphorus by colorimetry (AOAC, 1965).

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Table 1 suggests that an increase in fecal excretions of calcium occurred, but the difference was not significant. Wheat bran may not have much effect on calcium absorption. Fecal excretions of iron and zinc were increased by 20% wheat bran ($P<.05$), whereas phosphorus excretion was decreased. Phosphate shows a slight binding to fiber that supports strong binding of divalent ions (Ismail-Beigi et al., 1977). This research suggested that cellulase solubilized fiber and increased calcium, iron and zinc utilization by chicks. This supported the findings that minerals largely associated with cell wall components are solubilized by cellulase and/or protease activities (Kincaid and Cronrath, 1983).

Table 1. Effect of Dietary Wheat Bran Level Upon Calcium (Ca), Phosphorus (P), Iron (Fe) and Zinc (Zn) Excretion

Level of wheat bran in diet	Feed analyzed	Feces	Percent in feces
		Calcium, g	
0% wheat bran	.62	.42	68.3
10% wheat bran	.63	.47	76.4
20% wheat bran	.63	.55	88.4
20% + enzyme	.62	.48	77.4
		Phosphorus, g	
0% wheat bran	.46	$.22^{a}$	47.3^{a}
10% wheat bran	.47	$.18^{b}$	38.9^{b}
20% wheat bran	.48	$.19^{b}$	39.9^{b}
20% + enzyme	.47	$.18^{b}$	38.4^{b}
		Iron, µg	
0% wheat bran	5490	4567^{ab}	83.19^{a}
10% wheat bran	5345	5240^{bc}	104.28^{b}
20% wheat bran	5386	5795^{c}	107.60^{b}
20% + enzyme	5490	4273^{a}	77.84^{a}
		Zinc, µg	
0% wheat bran	2647	1722^{a}	65.06^{a}
10% wheat bran	2730	2234^{b}	81.84^{ab}
20% wheat bran	2692	2629^{b}	97.66^{b}
20% + enzyme	2659	1537^{a}	57.83^{a}

^{a,b,c} Means with different superscripts are significantly different ($P<.05$).

[d] Excreta were collected for 13 hours after start of feeding.