Impact of feeding reduced level of chelated trace minerals in replacement of inorganic sources on footpad health and broiler performance

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INTRODUCTION

Trace minerals are required to ensure the health and productivity of livestock species. While inorganic trace minerals (ITM) are relatively inexpensive, it is generally accepted that they suffer from relatively poor bioavailability compared to chelated trace minerals (CTM) (Leeson and Summers, 2001; O'Dell, 1989; Underwood and Suttle, 1999). The objective of this study was to evaluate the effect of ITM and CTM on performance, carcass yield and excretion of broilers.

MATERIALS AND METHODS

Trial 1: three treatments were randomly allocated to 30 floor pens (10 replicates of 14 birds each) from 1 to 42d (Table 1). Diets where formulated with all wheat (over 60%) with no enzyme and supplemented with ITM or CTM (MINTREX®, methionine hydroxy analogue chelates of Zn, Mn or Cu, Novus International, Inc). Performance and foot pad score were evaluated.

In Trial 2, 122,400 Ross-708 chicks were allocated to 8 identical production houses and reared over 54 days under commercial conditions. There were two treatments, as described in Table 1, and each treatment was fed to 4 houses of approximate 15,300 birds. Corn/soybean diets were formulated to meet requirements at all stages of growth and fed in four phases. The diets were balanced for methionine content to take account of the methionine activity in CTM treatment. Two hundred birds per house were weighed on Days 7, 14, 35 and 45 and overall performance was determined on Day 54 when foot pads were scored on a 5 point scale. On Day 53, 16 birds per house (8 males and 8 females) were sacrificed for analysis of tibia Zn content. In addition, at clear-out on Day 54, 54 birds (27 males and 27 females) were removed from each house and were individually tagged and weighed at the processing plant. At the end of study, two composite litter samples were taken from each house and analysed for trace mineral content. All parameters were analyzed by ANOVA using GLM procedures of SAS® with house as experimental unit except paw score where chi-square test was performed.

Table 1:
Description of dietary treatments

	Positive Control (ITM)	Negative Control (ITM-Low)	MINTREX (CTM)
Trial 1			
Zn	60 mg/kg as ZnO	32 mg/kg as ZnO	32 mg/kg as MINTREX Zn
Cu	15 mg/kg as CuSO4	8 mg/kg as CuSO4	8 mg/kg as MINTREX Cu
Mn	80 mg/kg as MnO	32 mg/kg as MnO	32 mg/kg as MINTREX Mn
Trial 2			
Zn	100mg/kg as ZnSO4	-	32 mg/kg as MINTREX Zn
Cu	125mg/kg as CuSO4	-	8 mg/kg as MINTREX Cu
Mn	90mg/kg as MnSO4	-	32 mg/kg as MINTREX Mn

RESULTS AND DISCUSSIONS

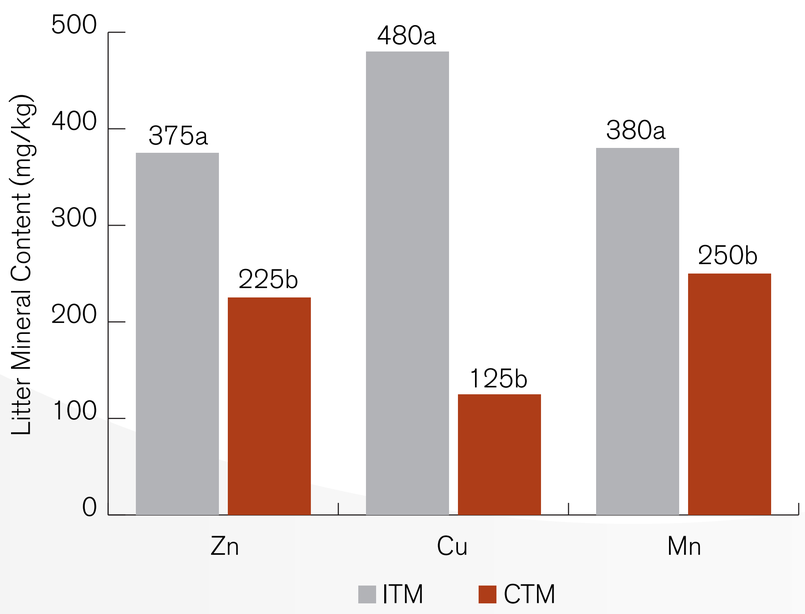
In trial 1, better performance was observed in birds fed CTM vs. ITM-Low ($P<0.05$) while in trial 2 there were no significant differences in live performance or carcass parameters measured between treatments. The evaluation of foot pad health using a point scale showed a significant higher percentage of healthy paws (grade 1 plus 2) in birds fed CTM in both trials (Table 2). Still, trial 2 presented lower litter mineral content for treatments supplemented with HMTBA chelated minerals (Figure 1).

Table 2:
Broiler performance, tibia Zn and paw score as affected by dietary treatments on day 54

Parameter	ITM	ITM-LOW	CTM	P value
Trial 1				
Body Wt (kg)	2.688[ab]	2.601[b]	2.705[a]	0.03
BWG (kg/d)	0.065[a]	0.062[b]	0.065[a]	0.03
Feed Intake (kg/d)	0.092	0.089	0.090	NS[2]
FCR (kg:kg)	1.432	1.449	1.420	NS
Mortality (birds)	3	5	6	NS
Grade 1+2 paw,%	38[ab]	30[a]	46[b]	0.01
Trial 2				
Body Wt (kg)	3.30	2.601[b]	3.28	NS
Feed Intake (kg/d)	6.56	0.089	6.56	NS
FCR (kg:kg)	2.04	1.449	2.04	NS
Mortality (birds)	3.42	5	3.48	NS
Tibia Zn (mg/kg)	80.08	-	80.74	NS
Grade 1+2 paw,%	34	30a	42	0.07

[1]Adjusted by mortality and culls. [2]Not significant. Values with a different superscripts differ significantly ($P<0.05$).

Figure 1:
Litter mineral concentration (Trial 2)



CONCLUSIONS

The development of chelated mineral sources with a higher bioavailability in the animal provides the opportunity to lower inclusion rates in the diet, while maintaining animal performance, and improve foot pad health. In addition, CTM supplementation can reduce litter mineral content and the environmental impact of commercial poultry operations.