

Replacement of inorganic Cu, Mn, Fe and Zn with Bioplex on growth performance and faecal mineral excretion in broilers.

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Abstract

In this broiler study, three treatments (7 pens of 40 birds/tr) were given: (A) control feed without added minerals, (B) control feed with added Cu (12.5 ppm on feed) and added Mn, Zn and Fe (40 ppm on feed); all inorganic sources and (C) equal to treatment B but using Bioplex Cu, Fe, Mn and Zn. Measurements of body weight gain and feed conversion ratio (FCR) indicate that body weight and feed conversion at 49 were not significantly different between treatments. Assuming that the daily mineral excretion in treatments B and C of the minerals already present in the raw materials was equal to that measured in treatment A, it could be calculated from the mineral excretion at day 35 that the reduction in excretion of mineral by supplying minerals in the organic (Bioplex) versus the inorganic from was 41.3, 49.8, 36.5 and 50.3 % of added mineral levels.

Introduction

The majority of research regarding the mineral/environmental impact of livestock and poultry production in recent years has focused on odor, nitrogen, and phosphorus. The newest area to receive research attention, from an environmental and animal health point of view, is in trace mineral nutrition and excretion. In the past, adding minerals to animal feeding has been done by addition of inorganic minerals as sulfates and oxides. The availability of such sources of minerals is quite low and it furthermore mostly depending on the origin of the minerals (geographic locations). This has led to 'over-supplementing' the feed with minerals, leading to increased excretion of these minerals. The 1994 NRC recommendations for 'nutritionally required amounts' of minerals as Cu, Zn, Mn and Fe in poultry feeds are based on research that dates from the period 1940 to 1970. Not only were these recommendations based on very few studies, also the availability of the mineral source is in most cases unknown. There it no certainty how much minerals 'available for absorption' were provided to the animals. The only solution to reduce this overfeeding and to decrease the excretion is to make these mineral more available so that lower doses can be applied in feed (Leeson, 2003). This can be done by providing minerals in chelated form to the animals. Bioplex Cu, Zn, Mn and Fe (Alltech Inc, USA) are minerals linked to a mixture of mono-, di- and tripeptide to yield 10 % organic mineral chelates, and are therefore valuable alternatives to replace the inorganic mineral sources in feeds.

Material and Methods

The trial was conducted at Moorland Farm, Lincs, UK according to a randomized block design. A total of 42 floor pens each with 40 birds (ROSS 308) per pen was used, 7 replicates per treatment. Animals were fed three consecutive feeds: starter (0-14 days of age), grower (15 till 28 days of age) and a finisher (29 till 49 days of age).

Treatments were:

- (A) No added minerals
- (B) 12.5 ppm Cu and 40 ppm Zn, Mn and Fe
- (C) 12.5 ppm Cu and 40 ppm Zn, Mn and Fe as Bioplex (Alltech Inc., USA).

Measurements of body weight gain and feed conversion ratio (FCR) was performed weekly till 49 d of age. Mortality was followed up during the whole trial. Faecal samples were taken at day 35 of the trial by collecting excreta over 24 hour period and taking 10 replicate samples per treatment. Samples were freeze-dried and analysed for dry matter, N, Zn, Mn, Cu and Fe. Dry matter and minerals were determined according to EU directive 81/680 and protein according to EU directive 93/28. Litter score was performed at day 21 and 42, while at the end of the trial (day 49) the hock score was determined. Data were analysed by ANOVA followed by a Tukey post hoc test using SPSS software. Results are considered significant when $P < 0.05$ unless otherwise mentioned.

Results and discussion

Feed analysis of the finisher feeds of the control feed without added minerals yielded values of 17.4, 74.2, 67.9 and 169.3 mg/kg of Cu, Mn, Zn and Fe respectively (treatment A), while levels in feeds B and C yielded values corresponding to the added level of minerals.

The results indicate that body weight and feed conversion at 49 were not significantly different between treatments (3.34 versus 3.42 and 3.36 kg for body weights and 1.943 versus 1.957 and 1.965 for feed conversion of treatments A, B and C respectively). The litter score at 21 and 42 days was very similar between treatments. The hock score at 49 days was on the average lower when Bioplex were added, but however not significantly (75.0, 77.9 and 70.7 for treatments A to C respectively).

Faecal mineral levels of all three treatments are given in Table 1. It can be seen that the addition of Bioplex Cu, Zn, Fe and Mn reduced the output of minerals in the faeces, while no difference in faecal dry matter was noted.

Table 1: Mineral and dry matter of the faecal material (n=10)

	Treatment		
	A	B	C
Cu (mg/kg DM)	19,3a	60,4b	43,4c
Mn (mg/kg DM)	128,4a	271,7b	200,3c
Zn (mg/kg DM)	102,1a	235,9b	187,1b
Fe (mg/kg DM)	356,1a	565,1b	459,9b
Dry matter (%)	25,3a	26,2a	24,8a

Figures in a row followed by the same letter are not significantly different ($P < 0.05$)

Assuming that mineral excretion in treatments B and C of the minerals already present in the feed (due to raw materials) was equal to treatment A, it could be calculated that the reduction in output of minerals originating from adding minerals in the organic versus the inorganic form was 17.0, 71.4, 48.8 and 105.2 mg/kg DM for Cu, Mn, Zn and Fe respectively (see

Table 1: values of treatment B minus values of treatment C). This is equal to a reduction in excretion of 41.3, 49.8, 36.5 and 50.3 % of added mineral levels when Bioplex was used instead of the inorganic form (calculated by: $(\text{level C} - \text{level B})/(\text{level B} - \text{level A}) \times 100 \%$) (Fig 1).

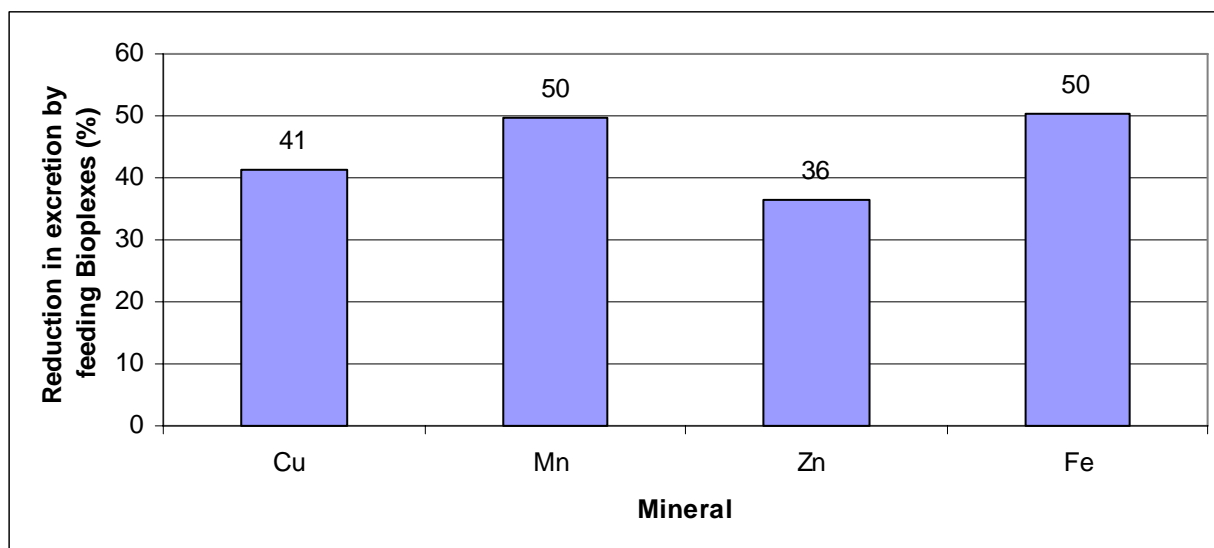


Fig. 1: Reduction on mineral excretion of the added minerals by replacing inorganic minerals by organic minerals (Bioplex)

Conclusion

It could be observed from this trial that the replacement of inorganic minerals by Bioplex yielded an important reduction in mineral excretion. Further research will reveal what is the actual requirement for available minerals (as Bioplex) for the different species and ones these levels will be know, a real estimation of the reduction of excretion of minerals when inorganic minerals will be removed from the feed and replaced by Bioplex minerals will be possible. From the results presented here, it can be seen that the hock score was lowered by supplementation of Bioplex minerals. However, the use of organic minerals instead of inorganic does not only be evaluated in terms of performance and excretion. Their effect on other items like skin integrity, gait, bone strength and feather score, which are linked to mineral nutrition, will also need to be assessed in future research.

References

EU legislation: <http://europa.eu.int/eur-lex/en/index.html>

LEESON, S. (2003) A new look at trace mineral nutrition of poultry: can we reduce environmental burden of poultry manure? In: Nutritional Biotechnology in the Feed and Food Industries. T. P. Lyons and K. A. Jacques Eds. Nottingham University Press, Nottingham, United Kingdom.