Low levels of copper and zinc proteinates maintain a normal mineral status in growing and finishing pigs

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A significant reduction in the levels of copper (Cu) (90%) and zinc (Zn) (40%) in the faeces of growing pigs was achieved without affecting pig growth when the inclusion level (IL) of Cu in the diet decreased from 50 ppm to 0 ppm Cu, and Zn from 80 to 40 ppm, both in the Bioplex® form (Hernández *et al.*, 2007). However it is important to establish if these low mineral levels enabled a normal mineral status to be maintained in the pigs. During digestion, minerals interact with each other and also with digesta components (e.g. phytate), which reduces the amount of each mineral that is absorbed. However it is likely that such interaction is less when minerals are supplied in the organic form due to the protection offered by the amino acid or peptides to which the mineral is chelated during manufacturing (Fairweather-Tait, 1996). In this study we examined the effect of feeding increasing IL of Cu together with low (treatments 1-4) or high (treatments 5-8) IL of Zn in the Bioplex® form on the status of biochemical markers of Cu, Zn and Fe in growing pigs.

The experiment was designed as a 2x4 factorial arrangement of treatments, with the respective factors being two IL of Bioplex® Zn (40 and 80 ppm) and four of Bioplex® Cu (0, 10, 30 and 50 ppm). A control treatment provided sulphates at levels of Cu and Zn similar to the high Bioplex® treatment. The study used 216 Large White x Landrace pigs from 25-107 kg live weight (LW) housed in three pens of eight pigs/treatment. Pigs were fed *ad libitum*. Blood samples were collected from the same random sub-sample of four pigs/pen on days zero, 21 and 49 of the experiment while samples of liver and bone were collected at slaughter (minimum of 104 kg LW). Analysis of variance, using the pig as a unit, was used to examine the main effects and all interactions on Cu, Zn and Fe in plasma and haemoglobin (Hb) and Cu content of red blood cells (RBC Cu) and Cu, Zn and Fe levels in liver and Zn in bone. Blood samples collected on days 21 and 49 were analyzed using repeated measures analysis of variance with blood levels on day zero as covariates.

Haemoglobin and plasma Fe levels were similar between treatments (P>0.05), while Cu (P=0.006) and Zn (P=0.011) levels increased with the IL of the minerals in the diet. Copper content in RBC decreased as the IL of Zn in the diet increased (P=0.006) (Figure 1). Hepatic Cu also increased with Cu IL (P=0.003), but at 0 ppm IL it was at the lower end of what is considered normal (Figure 2). The concentration of Zn in bone was within the normal range and decreased as the IL of Cu increased from 0 to 50 ppm (P=0.043). The results indicated that there were interactions between Cu and Zn at the levels studied. Although Hb and plasma Fe levels were within the normal range in pigs fed the 0 ppm IL Cu diet, storage of Cu in liver approached marginal levels. Since Cu is involved in Fe transport, a grower diet supplemented with at least 10 ppm Cu and 40 ppm Zn would be a safer recommendation.

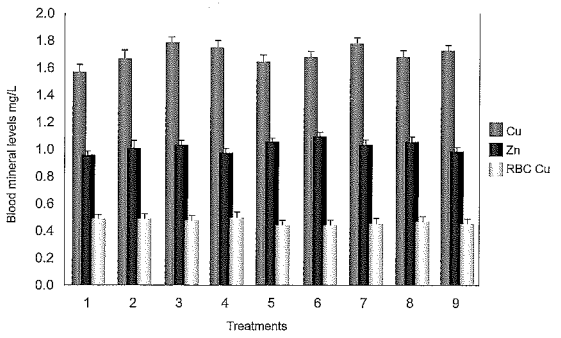

Figure 1. *Blood mineral levels (±SEM)*

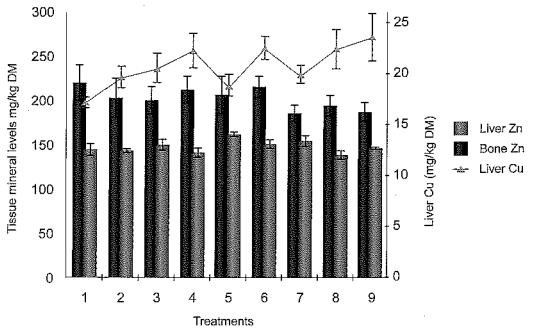

Figure 2. *Tissue mineral levels (±SEM)*

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References

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