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Zinc oxide used in high concentrations can increase growth and reduce diarrhea in piglets — but there is a downside from overuse.

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The effect of pharmacological levels of zinc oxide (ZnO) on piglet growth performance has been recently evaluated in a review involving 26 studies. Results indicated a significant (P<0.05) and positive effect of zinc supplementation on growth, feed intake and feed efficiency as shown in Figure 1.

Several hypotheses exist regarding the mode of actions to bring about these beneficial results, but the real mechanism is not fully known. Nevertheless, optimal levels of zinc oxide are around 3,000 ppm Zn. However, such use of pharmacological zinc oxide dosages has potentially some negative consequences for piglet health.

FIGURE 1. RATE OF IMPROVEMENT IN AVERAGE DAILY GAIN (ADG) WITH 2-3000 MG/KG ZN FROM ZNO FOR THE FIRST TWO WEEKS AFTER WEANING

Source: (Adapted from Sales, 2013)

Contamination by heavy metals

Impurities in commercial zinc oxide are a real problem when zinc quality is not strictly controlled. A study from the French institute, IFIP, indicated that cadmium concentration in high levels of zinc oxide appear to be antagonistic with feed acidifiers, like organic acids.
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Zinc toxicity
Pharmacological usage of zinc oxide may benefit piglets postweaning, but according to the US National Research Council (NRC), it may affect piglet health if used for a long period. The negative effect of high doses of ZnO fed for prolonged period are well known in the field, but the exact mechanism is not clarified, yet.

Environmental concerns
When the feed zinc concentration does not exceed 150 ppm, enrichment of zinc in the soil, from the resulting manure, does not exceed 3,000 μg/kg DM/year. In European conditions, using 3 kg ZnO per metric ton of feed during the first two weeks after weaning increases by almost 30 percent the total quantity of zinc excreted in the pig’s growing life. Technological treatments of pig slurry accentuate the problem as they concentrate the zinc in the solid fraction, and the level in the by-product may then exceed the maximum zinc level authorized for organic fertilizers in the EU.

Nutritional interactions
High levels of zinc result in overproduction of metallothionein. This intestinal transporter binds preferentially to copper and may lead to a sub-deficiency of this trace mineral. Because of high safety margins, bioavailability of iron does not seem to be significantly affected by high levels of zinc. Studies about interactions between zinc and phytase suggest that pharmacological dosages of zinc may have a negative effect on phytase activity and consequently on phytate-phosphorus liberation. This implies a reduced efficacy in phytase functions, and possible phosphorus deficiency for affected animals. The acid binding capacity of zinc oxide is the greatest among feedstuffs. Its acid-binding capacity at pH 4 is approximately 16,000 meq, compared with 13,000 meq for limestone flour and 12,000 meq for sodium bicarbonate, see Figure 2. Thus, high levels of zinc oxide appear to be antagonistic with feed acidifiers, like organic acids.
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