Dietary inclusion of low doses of microencapsulated zinc oxide affects inflammatory cytokine and tight junction protein expression in the ileum of piglets

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Aim of this study was to investigate the expression of inflammation markers and tight junctions protein (TJ) in the ileum of piglets fed with low doses of microencapsulated zinc oxide (ZnO; Zincoret, Vetagro SpA, Italy) in comparison with either a pharmaceutical dose of free ZnO (posi- tive control) or a negative control. Twenty-four pigs weaned at 28 d and divided in 4 groups, received either a basal diet (NC) or the basal diet added with zinc oxide at 2850 mg/kg (PC), or lipid encapsulated ZnO at 187 or 437 mg/kg (Zn200 and Zn400). After 15 d, 6 pigs per group were euthanized and ileal samples were collected for cytokines (IL-6, IL-10, TNF-a, and IFN-g), zonula occludens-1 (ZO-1), occludin (OCC) and claudin-1 at both mRNA and protein level. Data were analyzed with 1way ANOVA. Both groups receiving microencapsulated ZnO tended to have a reduced expression of IL-6 (–25%, P = 0.1), compared with both NC and PC. IFN-g expression was the lowest in Zn400 group (P = 0.02), and the protein tended to be lower in Zn400 than in PC (P = 0.07). Microencapsulated ZnO tended also to downregulate TNF-a expression compared with NC and PC (P = 0.1) and TNF content in ileal samples (P = 0.07). OCC gene expression was the lowest in Zn400 (P = 0.04), though the protein amount was 2–4 fold higher in Zn400 group compared with NC and PC, respectively (P < 0.001). ZO-1 expression was not affected by the treatments but ZO-1 amount in Zn400 group was 1.3–1.5 fold higher than in NC and PC, respectively (P < 0.001). Claudin-1 gene expression was 1.7–2.4 higher in Zn400 compared with NC and PC, respectively (P = 0.01). Overall, Zn200 group tended to have intermediate values between PC and Zn400. The results suggest that ZnO released from a lipid matrix is available in the ileum of piglets where it modulates the local immune response which, in turn, affects the intestinal permeability via the TJ proteins. In this respect, lipid encapsulated ZnO was effective at relatively low concentrations whereas free ZnO fed at 6–15 higher doses failed to be, probably because of a rapid metabolization in the upper gut.

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