Low doses of microencapsulated zinc oxide improve performance and modulate the ileum architecture, inflammatory cytokines and tight junctions expression of weaned pigs

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The aim of this study was to compare low doses of microencapsulated v. pharmacological ZnO in the diet of piglets on growth performance, ileum health status and architecture. One hundred and forty-four piglets weaned at 28 days and divided in 36 pens (two males and two females per pen), received a basal diet (control, Zn at 50 mg/kg) or the basal diet with ZnO at 3000 mg/kg (pZnO), or with lipid microencapsulated ZnO at 150 or 400 mg/kg (mZnO-300 and mZnO-800, respectively). After 14 and 42 days, three pigs per sex per treatment were euthanized to collect the ileum mucosa for immunohistochemistry, histomorphology, inflammatory cytokines and tight junction components gene expression. Data were analyzed with one-way ANOVA. At 0 to 14 days, the pZnO and mZnO-800 groups had greater average daily gain compared with control ($P < 0.05$). Gain to feed ratio (G : F) in the same time interval was higher in pZnO group compared with control thus resulting in higher BW ($P < 0.05$). At day 14, ileum villi height in mZnO-800 pigs was 343 μm v. 309 and 317 μm in control and pZnO, respectively ($P < 0.01$) and villi : crypts ratio (V : C), as well as cells positive to proliferating cell nuclear antigen (PCNA), were greater in all treated groups compared with control ($P < 0.01$). In mZnO-800 group, interferon-γ mRNA was the lowest ($P = 0.02$), and both pharmacological ZnO and mZnO reduced tumor necrosis factor-α protein level ($P < 0.0001$). Compared with pZnO group, mZnO-800 increased occludin and zonula occludens-1 protein level (1.6-fold and 1.3-fold, respectively; $P < 0.001$). At day 42, both groups receiving microencapsulated ZnO had 1.7 kg greater BW than control and did not differ from pZnO group ($P = 0.01$); ileum villi height and V : C ratio were the greatest for pZnO compared with the other groups, whereas PCNA-positive cells were the most numerous in mZnO-800 group ($P < 0.001$). In conclusion, pigs receiving low doses of microencapsulated ZnO had G : F comparable with those receiving pharmacological level of ZnO in the overall post-weaning phase. Moreover, in the first 2 weeks post-weaning, microencapsulated ZnO effect on inflammatory status and ileum structure and integrity was comparable with pharmacological ZnO.

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