

Impact of dietary organic acids and botanicals on intestinal integrity and inflammation in weaned pigs

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Organic acids, such as citric and sorbic acid, and pure plant-derived constituents, like monoterpenes and aldehydes, have a long history of use in pig feeding as alternatives to antibiotic growth promoters. However, their effects on the intestinal barrier function and inflammation have never been investigated. Therefore, aim of this study was to assess the impact of a microencapsulated mixture of citric acid and sorbic acid (OA) and pure botanicals, namely thymol and vanillin, (PB) on the intestinal integrity and functionality of weaned pigs and in vitro on Caco-2 cells. In the first study 20 piglets were divided in 2 groups and received either a basal diet or the basal diet supplemented with OA + PB (5 g/kg) for 2 weeks post-weaning at the end of which ileum and jejunum samples were collected for Ussing chambers analysis of trans-epithelial electrical resistance (TER), intermittent shortcircuit current (ISC), and dextran flux. Scrapings of ileum mucosa were also collected for cytokine analysis (n = 6). In the second study we measured the effect of these compounds directly on TER and permeability of Caco-2 monolayers treated with either 0.2 or 1 g/l of OA + PB. Pigs fed with OA + PB tended to have reduced ISC in the ileum (P < 0.07) and the ileal gene expression of IL-12, TGF- β , and IL-6 was down regulated. In the in vitro study on Caco-2 cells, TER was increased by the supplementation 0.2 g/l at 4, 6, and 14 days of the experiment, whereas 1 g/l increased TER at 10 and 12 days of treatment (P < 0.05). Dextran flux was not significantly affected though a decrease was observed at 7 and 14 days (P = 0.10 and P = 0.09, respectively). Overall, considering the results from both experiments, OA + PB improved the maturation of the intestinal mucosa by modulating the local and systemic inflammatory pressure ultimately resulting in a less permeable intestine, and eventually improving the growth of piglets prematurely weaned.

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