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Effects of plant polyphenols and mannan-oligosaccharides on growth performance, plasma antioxidant activity and health in E. Coli challenged piglets

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Abstract The objective of the current study was to evaluate the possible protective effects of plant polyphenols (PP, mixture containing anthocyanin, catechins, chlorgenic and oleuropein as active ingredients) and/or mannan-oligosaccharides (MOS) on growth performance, plasma antioxidant capacity and gut health of weanling piglets challenged with Escherichia coli. Ninety-six weanling piglets (LxLW)xPenerland, 22 days old, 6.85 ± 0.71 kg L.W.) were homogenously allocated to 24 pens and fed a basal diet for one week. After diet adaptation period, piglets were divided into 4 treatments (6 replicates per treatment, 4 piglets per replicate) and fed the basal diet (Ctr) or the basal diet supplemented with 0.1% of PP, MOS or PP+MOS. The study lasted 6 weeks. At 28 and 32 d on trial, all piglets were orally inoculated with 4 ml of E.coli (1×109cfu/ml) or saline water. Blood samples were collected at 14, 28, 32, 34 and 41 d to analyse plasma antioxidative property : Total Antioxidant Capacity (T-AOC), Malondialdehyde (MDA), Total Superoxide Dismutase (T-SOD), Catalase (CAT), Glutathione Peroxidase (GSH-Px), ceruloplasmin. At 32 and 34 d 1 piglet per replicate was slaughtered and ileal mucosa samples collected to determine the following intestinal inflammatory response parameters : inducible nitric oxide synthase (iNOS), myeloperoxidase (MPO) and nitric oxide (NO).

There were no significant effect of dietary treatments or challenge in growth of piglets. Feed Convertion Ratio (FCR) of Ctr piglets was lower than PP+MOS during pre-challenge ($P< 0.05$). Piglets fed diets supplemented with PP or MOS had lower FCR than Ctr and PP+MOS in week after challenge ($P< 0.05$).

Dietary PP partially enhanced the systemic antioxidant properties with higher T-AOC ($P= 0.08$) and lower MDA ($P= 0.08$) compared to Ctr at 28 d. At 32 d, challenge did not affect antioxidant capacity, while dietary PP or MOS increased plasma GSH-Px activity ($P= 0.003$). Diet supplemented with PP or PP+MOS increased CAT activity ($P= 0.013$). At 34 d, E. Coli increased plasma superoxide anion inhibiting capacity ($P< 0.01$), and hydroxyl radical inhibiting capacity ($P< 0.05$). Challenge tended to increase plasma ceruloplasmin at 32 d ($P< 0.05$).

E. Coli challenge increased ileal mucosa inflammatory enzyme activities of iNOS and MPO as well as NO production at 32 and 34 d. At 34 d, dietary PP or PP+MOS tended to inhibit the increase of iNOS activity (P= 0.07) and NO production (P= 0.08) and markedly suppressed the increase of MPO activity post infection (P< 0.05) due to challenge compared to Ctr.

Plant polyphenols and MOS supplementation had the potential to improve feed efficiency after E. Coli challenge, while a combination of PP and MOS had no effect. PP and MOS separately enhanced the antioxidant defense system before challenge. Dietary PP and MOS favorably affected the systemic antioxidant capacity during E. Coli post-challenge. Dietary PP shortened the ileal mucosa inflammatory response due to challenge via inhibiting the elevation of MPO and iNOS activity and NO production. The unfavorable response of the combination of PP and MOS might be indicative of some unclear interactive effects between the two additives.

Keywords plant polyphenols;mannan-oligosaccharides;antioxidant capacity;piglets