Effects of plant polyphenols and mannan-oligosaccharides on growth performance, antioxidant defense system and inflammatory response of ileal mucosa in Escherichia Coli challenged piglets

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Introduction
Polyphenols are a powerful kind of naturally bioactive compounds found in fruit, such as tea and wine, as well as in seeds like litchi bark (Hoim et al., 2002). Plant polyphenols (PP) had exhibited antimicrobial activity against bacteria causing foodborne disease (Tagut et al., 2004; Perdial et al., 2006; Kim et al., 2009). PP has also shown the ability to improve gut microflora balance (Ishihara et al., 2001). MOS is derived from the outer cell wall of yeast. Meta-analyses of literature had shown that MOS dietary supplementation improved body weight gain and feed efficiency in piglets (Eugeniusz et al., 2006). Enterotoxicogen Escherichia coli (ETEC), is reported to be one main etiological agent that cause piglet intestine mucosa damage after weaning. It is worthwhile to explore the possible protective role of natural food ingredient against the ETEC infection.

Aim of the study
To evaluate the effect of plant polyphenols (PP) (mix containing anthocyanin, catechins, chlorogenic and oleoresin) and/or mannan-oligosaccharides (MOS) on growth performance, plasma antioxidant capacity and ileal mucosa inflammatory responses in piglets E. coli challenged.

Material and Methods

Duration of the study: 41 d
96 piglets, (LmxN)P/S, 22 days old, 7.43 ± 0.89 kg L/W.
4 treatments starting after a 7-d adaptation to basal diet:
BD (Basal Diet), PP (BD + 0.1% PP), MOS (BD + 0.1% MOS), MOS+PP (BD + 0.1% MOS & PP)
48 piglets were orally inoculated with E. coli (4 ml 1×10^9 cfu/ml of virulent E. Coli 0149: F4(K88)-positive strain) at 28 and 32 d: the other 48 piglets were orally inoculated with the same amount of saline solution
Piglets were individually weighed at 7, 14, 21, 28, 32, 34 and 41 d
Blood samples from 1 piglet/replicate at 7, 28, 32, 34 and 41 d
Plasma antioxidant capacity: Total antioxidant capacity (T-AOC), Malondialdehyde (MDA), Total Superoxide Dismutase (T-SOD), Catalase (CAT) and Glutathione Peroxidase (GSH-Px)
I. piglet/replicate slaughtered at 28 and 34 d
Ileal mucosa inflammatory response: Inducible nitric oxide synthase (iNOS), Myeloperoxidase (MPO) and Nitric oxide (NO)
Data analyzed by GLM procedure of SPSS (15.0)

Results
BD and PP piglets had lower FCR before E. Coli challenge (P = 0.05) (Tab. 1). MOS supplemented piglets had higher ADG than BD from 32 to 34 d (P = 0.017). PP and MOS supplemented alone resulted in lower FCR from 28 to 34 d (P = 0.005) (Tab. 3). Dietary PP partially enhanced the systemic antioxidant properties with higher T-AOC (P = 0.060) and lower MDA (P = 0.076) compared to BD or PP-MOS at 28 d (Tab. 2). At 32 d, dietary PP or MOS increased plasma GSH-Px activity compared to BD (P = 0.003) (Tab. 3). Challenge increased plasma MDA content (P = 0.078) and decreased plasma T-AOC (P = 0.047) and CAT activity (P = 0.020) at 34 d. At 41 d dietary PP and PP-MOS supplemented piglets had an increased CAT activity compared to basal or MOS diet (P = 0.003). However a decrease of T-AOC was also observed in all challenged piglets at the same time (P = 0.021) (Fig. 1-2).
Challenge increased ileal mucosa inflammatory enzyme activities of iNOS and MPO as well as NO production as 32 and 34 d. At 34 d, dietary PP or PP+MOS tended to inhibit the increase of iNOS activity (P = 0.077) and NO production (P = 0.085) and markedly suppressed the increase of MPO activity post infection (P = 0.045) due to challenge compared to BD (Tab. 5).

Conclusions
Plant polyphenols administration had the potential to improve feed efficiency, while a combination 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 PP and MOS might be indicative of some unclear interactive effects between the two additives.

References