

Feeding trial

Improve performance and intestinal health - use HP 300 in AGP-free nursery diets



Summary

High digestibility and low feed costs are important drivers for animal producers. The use of in-feed antibiotic growth promoters (AGPs) improves performance of the animals by reducing (feed-induced) inflammatory response in the gastrointestinal tract and by limiting microbial growth. However, the use of AGPs is restricted more and more as it brings the risk of antibiotic resistance, which reduces feed efficiency and thus increases feed costs, but also poses a threat to human health. In the present trial, part of the **dietary soybean meal (SBM) was replaced with HP 300 and this resulted in similar performance as piglets fed an**

AGP supplemented diet. HP 300 (an enzyme-treated SBM with a reduced content of anti-nutritional factors) is less difficult to digest (causing less inflammation and damage to the gut). Both HP 300 and AGP-supplemented groups performed better than the negative control group (no HP 300, no AGP). Results further show that HP 300 alleviated weaning stress by improving oxidative status and reducing damage to the intestinal epithelium evident by improved morphology and increased expression of tight junction proteins.

Objective(s)

To study the effect of partial replacement of SBM with HP 300 in nursery diets on performance, scouring, antioxidant capacity and intestinal barrier function and comparing it with an in-feed AGP (chlortetracycline; CTC; 75 ppm) group and a negative control.

Results

- HP 300 significantly improved piglet growth by 8% and feed efficiency by 4 points (figure 1), and significantly reduced scouring by 50% compared with the negative control group.
- HP 300 improved the intestinal barrier function, reducing the risk of antigens and pathogens passing through the intestinal epithelium, evident by significantly higher expression of tight junction proteins in jejunal tissue compared to the negative control group (figure 2A).
- HP 300 significantly improved duodenal villus height and villus height to crypt depth ratio (VH:CD) compared to the negative control group (figure 2B), indicating enhanced digestion and absorption capacity and better gut health for HP 300 fed piglets.
- Oxidative status was improved by HP 300 as compared with the negative control, evident by a reduced level of malondialdehyde (MDA), a product of lipid peroxidation, and a higher level of the antioxidant enzyme glutathione peroxidase (GSH-Px) in serum (table 1).
- HP 300 resulted in similar performance (figure 1), same low scouring, similar high expression of tight junction proteins in jejunal tissue (figure 2A) and same good oxidative status (table 1) as AGP supplementation.
- On the other hand, HP 300 significantly improved duodenal villus height compared to AGP supplementation (figure 2B). Thus, suggesting that the higher content of beta-conglycinin in the AGP diet due to SBM elicited its well-known damaging effect on intestinal epithelium.



HP 300 resulted in similar piglet growth and FCR as in-feed AGP.

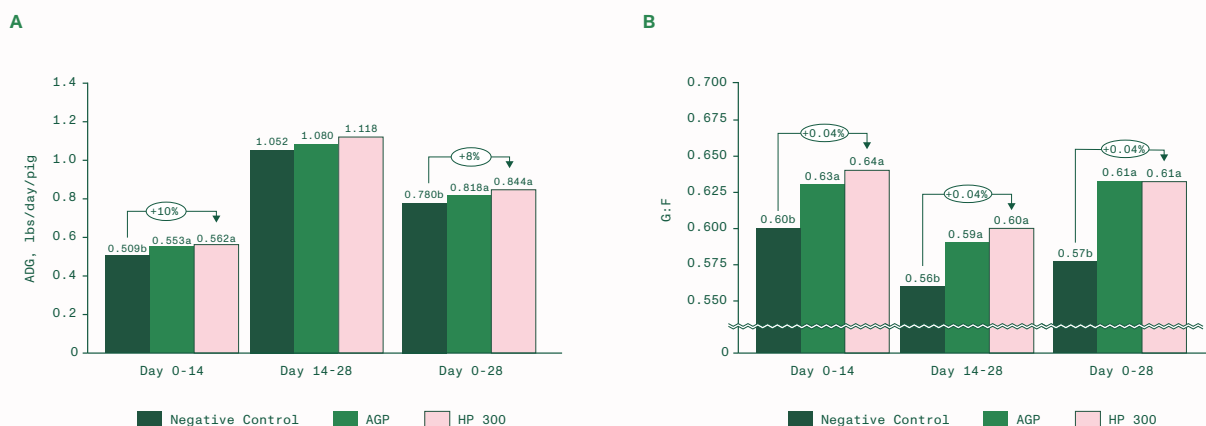


Figure 1 Average daily gain (ADG, lbs/day/pig; **A**) and gain to feed ratio (G:F; **B**) of piglets fed one of three dietary treatments: Negative control (NC), NC supplemented with 75 ppm CTC (positive control; AGP) or NC where part of SBM was replaced by HP 300. Different letters within an interval indicate significant difference ($p < 0.05$).

Alleviate intestinal stress and increase the intestinal surface area with HP 300

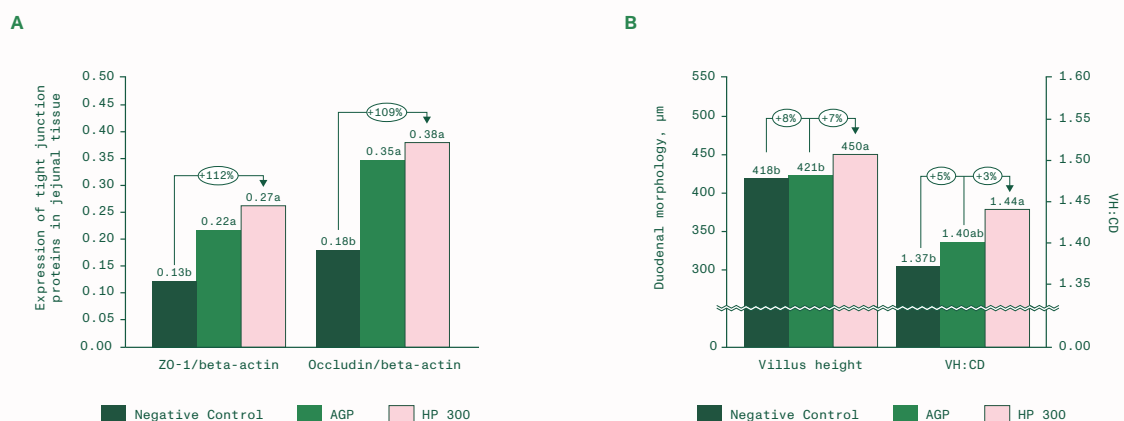


Figure 2 Expression of the tight junction proteins zonula occludens 1 (ZO-1) and occludin in jejunal tissue (**A**) and morphology of the duodenum at day 29 (**B**): Villus height (μm) and villus height to crypt depth ratio (VH:CD) in piglets fed negative control (NC), NC supplemented with 75 ppm CTC (positive control; AGP) or NC where part of SBM was replaced by HP 300. Different letters indicate significant difference ($p < 0.05$).

HP 300 improves oxidative status similar to the use of AGP

Table 1 Serum concentrations (mean±sem) of MDA and GSH-Px D14 post-weaning in piglets fed the negative control diet (NC), NC supplemented with 75 ppm CTC (positive control; AGP) or NC where part of SBM was replaced by HP 300.

	Negative control	AGP	HP 300	SEM
MDA, nmol/mL	5.27 ^a	3.60 ^b	4.24 ^b	0.26
GSH-Px, U/mL	510.44 ^b	632.42 ^a	623.08 ^a	15.21

^{a,b}Different superscript letters within a row indicate significant difference ($p < 0.05$).
MDA (malondialdehyde); GSH-Px (glutathione peroxidase).

Materials and methods

A total of 126 cross-bred (Duroc x Danish Landrace x Large white) weaned, mixed sex piglets (16.16 ± 2.51 lbs) were used.
3 dietary treatments in a 2-phase feeding program (phase 1: day 0-14 and phase 2: day 14-28):

- Corn-wheat-SBM based diet (negative control)
- Negative control with CTC at a sub-therapeutic dosage (AGP; 75 ppm feed; positive control)
- Negative control with 9% HP 300 replacing SBM in phase 1 and 7.5% HP 300 replacing SBM in phase 2 (HP 300)

Day 0-14 and day 14-28 diets were iso-energetic at 1.54 and 1.52 Mcal ME/lbs, respectively, iso-nitrogenous and contained 1.35% and 1.23% digestible lysine, respectively.

7 replicates per dietary treatment, 6 pigs (3 barrows and 3 gilts) per replicate. At day 14 and 28, blood samples were collected from the same pig (1 pig per pen) via the jugular vein to analyze for malondialdehyde (MDA), the product of lipid peroxidation, and glutathione peroxidase (GSH-Px), an antioxidant enzyme.

On day 29, the same pig (1 pig per pen) was sacrificed and intestinal tissue samples were collected to assess intestinal morphology and to determine the expression of tight junction proteins (Zonula Occludens-1, Occludin).

Location: China Agricultural University, China, 2017.

The data of this trial were published in a peer-reviewed journal: **Ma, X.K., Shang, Q.H., Wang, Q.Q., Hu, J.X., Piao, X.S. 2019. Comparative effects of enzymolytic soybean meal and antibiotics in diets on growth performance, antioxidant capacity, immunity, and intestinal barrier function in weaned pigs. Animal Feed Science and Technology, 248, 47-58.**



