RESEARCH ABSTRACT

PORK SAFETY

Title: Comparison of the effect of direct-fed microbials and antibiotic supplementation on the growth response of weanling pigs.
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Abstract: Pigs (n=252) from 30 litters were used to compare the effect of direct-fed microbials and antibiotic supplementation on the growth of nursery pigs. Beginning at farrowing, pigs were provided milk supplementation throughout lactation with or without the addition of *Lactobacillus brevis* (1E1) via an in-line system. These treatments were continued during the nursery period, in which pigs that were administered 1E1 in lactation continued to receive 1E1 through the watering system. At the start of the nursery phase, pigs were fed a control basal diet devoid of *Bacillus* or antibiotics, the basal diet with *Bacillus* cultures, or the basal diet with antibiotic supplementation. These dietary treatments were administered during Phase 1 (d 0 to 14), Phase 2 (d 14 to 28), and Phase 3 (d 28 to 38) post-weaning, in a 2 x 3 factorial design during the nursery period. On d 10, 20, and 38 after weaning, 12 pigs were euthanized, and gastrointestinal tissue sections were obtained for the enumeration of coliforms and *E. coli*, denaturing gradient gel electrophoresis (DGGE) of the GI microbial community DNA, and for villus, crypt, and goblet cell morphology measurements. Prior to euthanization a blood sample was collected for analysis of blood monocyte/macrophage phagocytosis. Data were analyzed using the GLM procedure of SAS, and the effects of 1E1 supplementation, dietary treatments, and their interaction were evaluated. No interactions were observed between 1E1supplementation and the dietary treatments ($P > 0.15$) for growth performance measurements. Pigs supplemented with 1E1 had greater ADG ($P < 0.05$) during Phase 2 and the overall nursery period (d 0 to 38), greater ADFI ($P < 0.05$) during Phase 3 and the overall nursery period, but tended to have lower gain:feed ($P < 0.10$) during Phase 3 of the nursery period. Pigs fed 1E1 were 1.58 kg heavier at the end of the nursery period than those fed milk replacer without 1E1 ($P < 0.01$).

Pigs supplemented with antibiotics during the nursery had greater ($P < 0.01$) ADG during Phase 2 and the overall nursery period, and greater ($P < 0.01$) ADFI during Phase 3 than pigs fed the basal diet or pigs fed *Bacillus*. Although pigs supplemented with antibiotics had greater ($P < 0.05$) gain:feed than pigs fed *Bacillus* during Phase 2, pigs fed *Bacillus* had greater ($P < 0.01$) gain:feed during Phase 3 than pigs fed the basal diet or those fed antibiotics. In the duodenum, pigs administered 1E1 had greater ($P < 0.05$) coliform counts on d 10 after weaning compared to pigs that did not receive 1E1, however, coliform counts were highest on d 20 after weaning in pigs that did not receive 1E1 and tended to be greater ($P = 0.10$) than coliform counts from pigs administered 1E1 (1E1 x day interaction, $P < 0.05$). In the jejunum, the greatest adjusted *E. coli* counts were observed on d 20 after weaning in pigs not provided with 1E1, and these counts were significantly greater ($P < 0.05$) than those observed on d 20 after weaning when pigs were administered 1E1. The administration of 1E1 did not affect adjusted *E. coli* counts within the jejunum on d 10 or d 38 after weaning (1E1 x day interaction, $P < 0.05$). Pigs provided 1E1 had a lower ($P < 0.05$) villus height:crypt depth ratio in the duodenum and the jejunum on d 38 after weaning compared to pigs not administered 1E1, whereas there was no difference in the villus:crypt ratio between the 1E1 treatments on d 10 and d 20 after weaning (1E1 x day interaction, $P < 0.01$). In the ileum, villus height was greater ($P < 0.05$) in pigs fed the antibiotic diet compared to pigs fed the control diet or *Bacillus* on d 10 after weaning, however, pigs fed *Bacillus* exhibited greater ($P < 0.05$) villus height within the ileum on d 38 after weaning compared to the other dietary treatments (nursery diet x day interaction, $P < 0.01$). In the duodenum, the administration of 1E1 decreased ($P < 0.05$) the number of sulfated goblet cells while increasing ($P < 0.05$) the number of acidic goblet cells, compared to pigs that did not receive 1E1. Pigs fed diets containing *Bacillus* and antibiotic had a lower ($P < 0.05$) number of sulfated goblet cells in the duodenum than pigs fed the control diet during the nursery period. Also, acidic goblet cells were more abundant in the jejunum of pigs administered 1E1 compared to pigs not provided 1E1, whereas sulfated goblet cells were less abundant in the jejunum when pigs were provided with 1E1. Pigs fed the control diet and those fed *Bacillus* had a greater ($P < 0.09$) percentage of phagocytic monocyte/macrophages than pigs fed the antibiotic diet in the absence of 1E1 administration. However, with 1E1 administration, pigs fed *Bacillus* had fewer phagocytic monocyte/macrophages than pigs fed the control diet (1E1 x diet interaction, $P < 0.10$). On d 10 after weaning, pigs fed the *Bacillus* diet in the absence of 1E1 had a higher ($P < 0.05$) proportion of $CD4^+CD8^-$ lymphocytes within the $CD25^+$ population than pigs fed the control diet without 1E1. Although experimental treatments did not alter ($P > 0.05$) this cell population on d 20 after weaning, the proportion of $CD4^+CD8^-$ within the $CD25^+$ population was higher ($P < 0.05$) in pigs fed *Bacillus* in the presence of 1E1 compared to pigs fed *Bacillus* and antibiotic in the absence of 1E1 and the control and antibiotic diets in the presence of 1E1 (1E1 x diet x day interaction, $P = 0.04$; Figure 18). This study indicates that direct-fed microbial supplementation improves the growth performance of pigs during the nursery period, and results in potentially beneficial alterations in gastrointestinal microflora, morphology, monocyte/macrophage activity, and immune cell populations.

Key Words: Swine, Lactobacillus, Feed Supplements