RESEARCH ABSTRACT

ANIMAL SCIENCE

Title: Understanding the relationship between immune response, intestinal microbial ecology and growth performance in nursery pigs fed diets with, or without in-feed antibiotics or a combination of beta-glucan and vitamin C. **NPB # 06-103**

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III. Scientific Abstract

Weaning and the subsequent nursery phase represent a time of gastrointestinal and immune instability for the pig. This research project was developed to understand the effect(s) of two commonly used in-feed antibiotics (carbadox and tylosin), and a dietary combination of beta-glucan and vitamin C on the immune system and intestinal bacteria of nursery pigs. Two hundred and sixteen crossbred weanling pigs were used in a 4-week experiment. Pigs were weaned at 21 days of age, and housed in a total of 24 pens (9 pigs/pen). Diets were typical commercial nursery diets and experimental treatments included; 1) control diet with no antibiotic added; 2) in-feed antibiotic A (carbadox); 3) in-feed antibiotic B (tylosin); 4) in-feed beta-glucan and Vitamin C supplementation. Growth performance (i.e., weight gain and weight gain to feed intake ratio) were determined weekly throughout the experiment. Fecal samples were collected from each pen on a weekly basis to monitor common intestinal bacteria (*Escherichia coli*, coliforms, and *Lactobacillli*). At weaning, 2 weeks post-weaning (35 days of age), and 4 weeks post-weaning (49 days of age), 1 pig per pen (6 pigs/treatment) was randomly selected for euthanasia and collection of intestinal samples. Intestinal contents were collected for microbiological analysis. Blood was collected to determine the red blood cell (RBC) percentage and total white blood cell (WBC) percentage, as well as a quantitative analysis of different types of white blood cells (neutrophils, lymphocytes, and monocytes). Mesenteric lymph nodes and lung tissue (approximately 3 cm^2) were also collected, and the relative abundance of an anti-microbial compound (PR-39), bacterial recognition molecules (TLR 2, 4), and the inflammatory molecule IL-1 and its competitor, IL-1 receptor antagonist, were determined. Growth performance for weeks 1, 2, 3, and 4 p.w., as well as for the collective 4 week period (i.e., overall), did not differ between males and females nor for pigs receiving different treatments. Intestinal bacterial populations did not differ between males and females nor for pigs that received different treatments and were euthanized at weaning and 2 weeks post-weaning. However, at week 4 post-weaning ileal *Lactobacilli* counts were less in piglets fed BGA compared to those fed the control diet, carbadox, or tylosin ($p<0.05$). Bacteria found in the feces were not affected by gender or by any of the four treatments in weeks 1, 2, and 3 post-weaning. However, at week 4 p.w., males fed BGA had an increase in fecal coliform counts compared to females fed tylosin ($p<0.05$). Analysis of the MLN showed an elevation of PR-39, TLR 2, TLR 4, IL-1, and IL-1Ra expression at week 2 p.w., which returned to levels detected at weaning by week 4 post-weaning. Neutrophil count and total WBC count were greatest in BGA treated pigs, especially in relation to

carbadox treated pigs, at 2 weeks post-weaning ($p<0.05$). Analysis of the lung tissue revealed that pigs fed the diet without antibiotics (i.e., control) had either an increasing expression of PR-39, TLR 2, TLR 4, IL-1, and IL-1Ra from week 2 to week 4 p.w., or the expression of each remained constant. The expression for the tylosin and BGA treated pigs was similar for IL-1 and PR-39 in the lung tissues. Although the use of tylosin in nursery diets did not improve growth performance, it was most favorable to the pig's immune system by protecting the pig from an increase in intestinal pathogens and insuring the health of the animals. Administration of beta-glucan and vitamin C may be an attractive alternative to antibiotics, but additional research needs to be conducted.