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Effect of Host-Microbe Interactions in the Gut on Pig Performance

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The intestine of the pig, and other mammals, is a key organ that is involved in digestion and absorption of nutrients, and is a key component in maintaining overall health. Dr. H. R. Gaskins from the University of Illinois recently presented on the importance of the host-microbe relationship in the intestine on animal performance, providing a better understanding of pig gut health and potential implications for feeding programs, and some of his comments are summarized in this article.

The intestine serves as the first line defense against pathogens. Pathogenic bacteria in the intestine compete for nutrients and enteric attachment sites, and reduce overall intestinal function. The normal microbial population in the intestine of the pig is beneficial, providing the host with nutrients such as short-chain fatty acids, vitamin K, B vitamins, and amino acids, but also increases costs associated with maintenance of this organ. Normal intestinal bacteria assist in preventing pathogenic organisms from colonizing the gut by competing for nutrients and attachment sites, as well as producing various antimicrobial compounds, volatile fatty acids, and other compounds that are unfavorable to pathogens. The influence bacterial cells have on animal health, nutrient utilization, and normal body function is highlight when one considers that bacterial cells outnumber host cells ten to one.

The intestine itself, of course, plays an important role in providing defense mechanisms against pathogens. A mucus layer covers the internal lining of the gastro-intestinal tract, providing protection, lubrication, and transport of nutrients. Mucin carbohydrates contained therein bind to or repel microbial receptors, generally aiding in preventing many pathogens from attaching to binding sites on the intestine and causing disease. The epithelium, underlying the mucus layer, contains various cells that are involved in physically prevent pathogens from crossing the intestine, presenting antigens, and synthesizing and secreting numerous inflammatory and regulatory cytokines essential for immune response. Populations of lymphocytes, macrophages, and other pathogen-fighting cells are contained in the lamina propria, located beneath the epithelium. Intestinal T lymphocytes, or T cells, are key components of the front-line defense system, activating immune response and assisting in destroying infected cells. Secretory IgA, synthesized by B lymphocytes, provide more specific protection against pathogens upon reexposure, preventing adherence to the epithelium.

The intestine itself has many defense mechanisms to cope with pathogens, but a significant proportion of nutrients are utilized by the animal to support and mount these defense mechanisms. Bacterial colonization, even by beneficial microbes, does negatively impact efficiency of growth, and is a major reason why antibiotics provide growth-enhancing effects when included in diets. Therefore, it is paramount that management and animal care practices are incorporated to reduce the amount of pathogen loading (strict biosecurity procedures, all-in all-out production, stringent cleaning and disinfection of facilities and equipment, etc…). However, when a pathogen load is encountered, it is the synergistic interaction of the host intestine with normal microbial population that serves as the front-line defense mechanism to prevent reduced animal health and performance. Generating a balance between beneficial microbial populations

and nutrient usage towards maintenance provides an opportunity to maximize animal performance, but is not easily accomplished.