Nonruminant Nutrition Symposium: Models for Disease × Nutrition Evaluation and the Impact of Nutrition on Health, Disease, and/or Recovery

691 Possible nutritional interventions to improve intestinal health. J. Escobar*, M. A. Ponder, K. L. Price, and H. B. Lee, *Virginia Polytechnic Institute and State University*, *Blacksburg*.

In sick animals, the anorectic response is part of a series of complex but coordinated physiological and behavioral adaptations to recover from a disease episode. Thus, it is not surprising that animals appear to have a physiological preference for using endogenous nutrients over dietary supply, particularly during acute immune activation. Because survival and recovery have utmost nutritional priority, sick animals usually exhibit reduced growth performance, and nutritionists commonly rely on non-productive outcomes to determine the benefits of nutritional interventions. The effect supplementing diets with several nutrients and feed additives on intestinal health have been evaluated in various animal models using a wide variety of single immunological challenges. Our laboratory is currently using both *Salmonella*- and lipopolysaccharide-challenged pigs to determine how immune activation alters nutrient utilization as well as the contribution of prebiotic supplementation on intestinal health and recovery from an enteric infection. Results from our studies indicate increased amino acid catabolism during acute experimental sepsis and impaired amino acid digestibility during a bacterial infection of the gastrointestinal tract. Further, inclusion of a yeast-derived prebiotic in the diet of Salmonella-challenged pigs appears to improve fecal beneficial bacteria and intestinal morphology, which were associated with an enhanced growth performance during the recovery phase. The appropriateness of the animal model and the immune challenge, however, must be carefully considered when making intestinal health inferences of nutrients and supplements to be implemented in commercial animal production systems, which are usually affected by diseases of complex etiology.

Key Words: disease, intestine, amino acids

692 Challenge models to study foodborne pathogen transmission and test intervention strategies. P. Ebner*, *Purdue University*, *West Lafayette, IN*.

Foodborne illnesses are continually associated with the consumption of contaminated animal products (among other foods). As most of the more notable bacterial foodborne pathogens have reservoirs in at least one livestock species (e.g., *Campylobacter* in poultry, *Salmonella* in pork, *E. coli* O157:H7 in beef cattle), preharvest or on-farm intervention strategies aim to improve food safety by decreasing the amount and types of pathogens that animals bring with them into the processing facility. Various challenge models have been used in assessing the efficacy of these different strategies. Foodborne pathogen infection models present some special challenges as the organisms are, in many cases, among the normal microbiota of the animal. In addition, many of these organisms are seemingly ubiquitous within livestock facilities and are regularly isolated from the general environment. Such epidemiological factors should be taken into account when assessing the value of a certain infection model. Nutrition and management factors must also be taken under consideration with foodborne pathogen challenge models to varying degrees depending upon the organism. We have experimented with different models to study *Salmonella* infections in livestock. A major focus of our laboratory currently is the development of different methods to limit *Salmonella* infections associated with transport and lairage due to contaminated post-farm environments (e.g., contaminated trailers, crates or holding pens). Once a treatment has proven effective using a basic challenge such as co-inoculation, we usually progress to more complex models. As an example, we have simulated contaminated trailers or holding pens by inoculating small groups of seeder animals and then introducing unrelated treated and non-treated animals to the contaminated pen. These models, also used by other groups with *Salmonella* and other foodborne pathogens, attempt to more closely mimic the quantities and routes of exposure that the animal might encounter under a production setting in effort to better understand on-farm transmission and effectively reduce pre-processing pathogen loads in food animals.

Key Words: foodborne pathogens, *Salmonella*

693 Nutritional modulation of the gastrointestinal barrier and its role in gut health and disease. A. J. Moeser*, *North Carolina State University*, *Raleigh*.

Enteric disease is a major cause of mortality and production inefficiencies in swine. Environmental factors such as stress and nutrition have a profound influence on gut health and can triggers the onset of enteric disease but the mechanisms are poorly understood. Our studies have focused on elucidating how production stressors and nutritional factors influence the intestinal barrier, a critical line of defense against pathogens and antigens residing in the intestinal lumen. We have shown that stressors associated with current weaning practices have a deleterious impact on intestinal barrier function measured by increased intestinal permeability and mucosal inflammation. Furthermore, it was shown that weaning age is an important factor in determining the severity and duration of weaning-induced intestinal barrier dysfunction as incrementally increasing weaning age from 16 to 23 d of age led to graded improvements in post-weaning mucosal barrier function. Mechanisms underlying this weaning event were shown to be mediated through peripheral stress signaling pathways and innate immune cell dysfunction. Recent experiments with weaned pigs showed that early weaning exacerbated clinical disease and intestinal injury in response to an *E. coli* challenge. Furthermore, it was shown that increasing weaning age from 18 to 20 d of age ameliorated enteric disease *E. coli* challenged pigs. Given the important role of the intestinal barrier in gut health, we have begun studies investigating nutritional factors that can regulate the intestinal barrier. Beneficial results were shown with supplemental plasma protein into post-weaning diets specifically ameliorating a portion of the barrier dysfunction and intestinal inflammation and diarrhea that is associated with early weaning. In summary, the integrity of intestinal mucosal barrier is critical to pig health and can be influenced by production stress and nutrition. Identifying strategies to enhance intestinal barrier health in the pigs will be important to promote optimal pig health, performance, and well-being.

Key Words: intestine, stress, weaning

694 Is immunomodulation good? K. C. Klasing*, *University of California*, *Davis*.

Nutrients, pharmacological agents, and immunogens are often administered to animals for the purpose of immunomodulation, which is defined as shifting the immune systems response to pathogens or other triggers. The underlying principle is that the immune system can be improved by an informed intervention. Implicit in the idea of immunomodulation is that an animals immune system is mal-regulated or mal-designed as the result of improper genetics or environment and we know how to fix

it. Several examples of immunomodulation from the nutrition literature indicate that immunomodulation is situation dependent: improving disease resistance against some pathogens while impairing it against others. An understanding of the polarized response of the immune system in context of the optimal protective immune response helps explain this dichotomy. Pathogens often subvert the immune system to marshal a vigorous, yet counterproductive response. Modulation of the immune system in a more protective direction helps. However, this same immunomodulation may impair the protective response to other pathogens with different pathogenicity mechanisms. Thus, the value of immunomodulation appears to be context specific. When a single pathogen is dominant in a production system and the type of protective immune response is clearly understood, an immunomodulator that is known to shift the immune system in the protective direction is good for that pathogen; but not necessarily for others.

Key Words: nutrition, immunity, modulation