ROLE OF NUTRITION IN PROMOTING SWINE HEALTH

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ABSTRACT

In response to consumer demand and recent changes to antimicrobial regulations, producers are taking great steps to reduce use of antibiotics in swine production. A more judicious use of antimicrobials puts pressure on swine nutritionists to explore alternative feeding strategies to optimize health of the herd. This workshop will focus on several concepts to consider how to formulate diets that promote swine health.

Keywords: Additives, Feeding strategies, Intestinal health, Pigs

MYCOTOXINS

Mycotoxins are metabolites produced by field crop moulds. The 2018 southwestern Ontario corn crop was likely the worst on record for quality. Fusarium mould produced deoxynivalenol (DON) levels in Ontario grain corn so high that made it unmarketable. Pigs are particularly susceptible to DON in feed. Also called vomixtoxin, DON is a mycotoxin known to impair the health of pigs by causing feed refusal, diarrhea and as the name suggests, vomiting and stomach ulcers. Perhaps more concerning, is the immuno-suppressive impact of DON. The pigs' ability to combat viral and bacterial infections through immune cell production of antibodies can be impaired by DON levels of less than 5ppm in the feed. Since much of Ontario's corn has been contaminated with DON, feedmills and farms have taken on various strategies to make use of local grain all while managing risk associated with DON feeding. These strategies include dilution of contaminated grain with cleaner grain, cleaning out fine particles where the highest degree of contamination resides and using toxin mitigation additives in the feed.

VITAMINS

Today's high lean genotype has an incredible ability of converting feed into pork carcass. Research for fine tuning amino acid and energy requirements of these improved pigs has been relentless. However, new information into vitamin needs is harder to find. With pigs doing more with less, the concept of increased requirements needs further exploration. The health benefits of 13 different vitamins are numerous. Some may play a bigger role in maintaining healthy herds today than 10 or 20 years ago. Vitamin D is one such vitamin that is crucial to the mineral metabolism pathway. With fast growing genetics demonstrating increased susceptibility to lameness, stiffness, and bone density issues, we should consider the effects of lower vitamin D when formulating diets. Recently, world markets were shorted on vitamin supply, particularly vitamins A and E. As such, many nutritionists had no choice but to lower vitamin levels for swine due to cost and availability. Some hypothesized performance challenges in 2018 may have been experienced due to subclinical deficiencies.

PLANT EXTRACTS

One exciting category of alternatives to conventional antibiotic use in livestock production is plant extracts. Also referred to as essential oils, concentrated extracts can exploit natural antimicrobial characteristics of various compounds found in plants such as cinnamon, oregano, and thyme, to name a few. In vitro studies are quick to demonstrate effectivity of these extracts on bacterial populations, however, in vivo animal studies show more work needs to be done to understand true mode of action. Another exciting addition to the "nutraceutical" lineup is commercially available medium chain fatty acids (MCFA) from plant sources like palm kernel and coconut oil. MCFAs are believed to combat pathogenic bacteria at the gut level of the pig through penetration of the bacterial cell membrane and inhibiting important DNA replication needed for growth.

PARTICLE SIZE AND ULCERS

Reducing the particle size of corn increases the digestibility of energy and in general, the smaller the particle size is the greater is the ME concentration of corn. In general, if particle size is reduced from around 800 to around 300 microns, the ME increases by around 25 kcal per kg for each 100 microns particle size is reduced. In other words, by reducing the particle size of corn from 800 to 300 microns, approximately 1.75% fat can be replaced by corn in the diet without changing the energy value of the diet. Reduction of particle size, therefore, represents a significant saving in formulation of diets for growing finishing pigs. For other cereal grains, a similar relationship between particle size and ME exists although the magnitude of the increased ME that is a result of particle size reduction may be different.

However, the down side to reducing particle side is that pigs are more prone to developing gastric ulcers. If these ulcers results in increased death losses then some of the economic benefits of reducing particle size will be eliminated. It is, therefore, from both an economical and an animal welfare point of view, necessary that a balance between particle size and prevention of ulcers is identified. This balance may be different among genetic lines of pigs, among diets with different ingredient compositions, and between pelleted and meal diets.

COPPER AND ZINC

The requirement for copper by pigs is likely less than 10 mg per kg of feed and the requirement for zinc is around 75 mg per kg. However, it is well established that greater concentrations of both copper and zinc in diets for weanling pigs may reduce scouring and increase growth performance. The benefits of adding extra zinc (up to 3,000 mg per kg) is primarily limited to the post-weaning nursery period, whereas benefits of additional copper (100 to 250 mg per kg) are realized all the way to market. The reason for the beneficial effects of both copper and zinc is most likely that the intestinal microbiome is changed with a reduction in concentrations of pathogens, which reduces the risk of pigs developing diarrhea. In addition, results of recent research have indicated that elevated levels of copper in diets for growing pigs also results in improved post absorptive energy metabolism, which may be a result of a more efficient utilization of absorbed dietary lipids.

Using 100 to 250 mg per kg of copper in diets for pigs also appears to result in a general increase in the immune system. Pigs fed high-copper diets are, therefore, better able to resist a particular environmental or dietary challenge and copper appears to provide insurance against pigs reducing growth performance due to diseases.

FIBER IN DIETS FOR PIGS

Fiber is usually not included in diets for pigs to improve health but there is evidence that in particular in weanling pigs, it may be beneficial to add small amounts of certain dietary fiber. Indeed, diets for weanling pigs based on barley or oats result in improved pig growth performance and reduced scouring compared with pigs fed diets based on only corn or wheat. Beneficial effects of adding small amounts of pure oat fiber to diets for weanling pigs have also been reported. The reason for these positive effects is believed to be that the beta-glucans and possibly other fiber components in barley and wheat results in increased fermentation and increased synthesis of lactic acid in the hindgut of pigs, which in turn will reduce colonic pH and therefore create an environment that is unfavourable for intestinal pathogens. This may result in reduced incidence of diarrhea, improved intestinal morphology, and improved microbiota with an increase in concentrations of beneficial bacteria such as lactobacilli and bifido bacterium. Thus, it is possible that the fibers in barley and oats may act like prebiotics in the intestinal tract of weanling pigs and thereby improve intestinal health.

LOW-PROTEIN DIETS FOR NEWLY WEANED PIGS

Excess dietary crude protein has a negative impact on post-weaning diarrhea and reductions in dietary crude protein may, therefore, reduce diarrhea. The reason for this most likely is that by reducing dietary crude protein, the amount of undigested crude protein that reaches the hindgut is reduced and this will in turn reduce pathogenic growth, fermentation of protein in the hind gut, and synthesis of ammonia and amines. It is also possible that reduced dietary crude protein has a positive impact on intestinal permeability because diarrhea increases intestinal permeability and gut leaking and by eliminating diarrhea, a healthier intestinal tract can be maintained. It is therefore advisable that dietary crude protein in diets for newly weaned pigs is maintained at 16 to 19%. By reducing dietary crude protein to this level, pig growth performance may be reduced, but this reduction will be compensated by improved growth rate during the following period. The main focus should therefore be on preventing diarrhea during the post weaning period.