Low Crude Protein for post-weaning diarrhea

Michael Bosompem, M.Sc.,
Graduate Student,
Animal and Poultry Science,
University of Saskatchewan

Micheal is a Ph.D. student in supervised by Drs Michael Wellington and Andrew van Kessel. Michael returned to the University of Saskatchewan for his Ph.D. program in January 2025 following five years working in the Canadian swine industry as a nutritionist, which began after he earned his M.Sc. in Animal Science from the College of Agriculture and Bioresources.

Introduction

The rapidly growing weanling pig has a high requirement for total nitrogen (crude protein, CP) and amino acids (AA). These requirements are typically met using highly nutritious vegetable protein such as soy bean meal and canola meal. While these ingredients have a generally good essential amino acid profile (EAA), increased supplementation is inadequate to meet EAA requirements, making supplementation of crystalline EAA necessary.

Increased protein inclusion can lead to post-weaning diarrhea (PWD) as a result of the microbial fermentation of excess undigested or partially-digested proteins reaching the hindgut. Fermentation of this protein can lead to the production of harmful metabolites, upsetting the commensal microflora and intestinal epithelium, resulting in gastrointestinal upset and diarrhea. Significant losses related to morbidity and mortality may occur, and impacted animals may exhibit poor performance for an extended period of time. The use of low crude protein diets has been suggested as an approach to mitigate this issue, and has been proven to be an efficient method when adopted.

What we did

While the use of low CP diets has been seen to be effective in reducing the incidence of PWD, findings from published literature on the ideal concentration of CP in nursery diets are inconsistent. To determine how piglets performed when fed a low CP diet that met EAA requirements, we tested five diets, formulated at 14, 16, 18, 20, and 22% CP. The base diets included wheat, barley, and soy bean meal, and were EAA balanced. These diets were fed to 360 mixed-sex weanling piglets, with 72 pigs per treatment. Diets were fed in two phases, Phase 1 for days 0 – 21 of the trial, and Phase 2 for days 22 – 42. Piglet weight and feed intake were recorded over the course of the trial.

This project was completed in cooperation with Truow Nutrition, and was run through their Swine Research Centre in the Netherlands.

What we found

Piglets fed diets containing 18-22% CP displayed the highest final body weight (Figure 1), accompanied by the highest average daily gain (ADG). Average daily feed intake (ADFI) also increased as CP inclusion increased. Gain-to-feed ratio (G:F) displayed the same impact, with CP provision between 18-22% resulting in higher ratios.

To assess which diet contained the optimal CP level, a linear breakpoint model was used (Figure 1). It was determined that the provision of CP at 18% resulted in optimal performance when all EAA requirements were met. This finding was supported when PWD was assessed, as the incidence of diarrhea increased

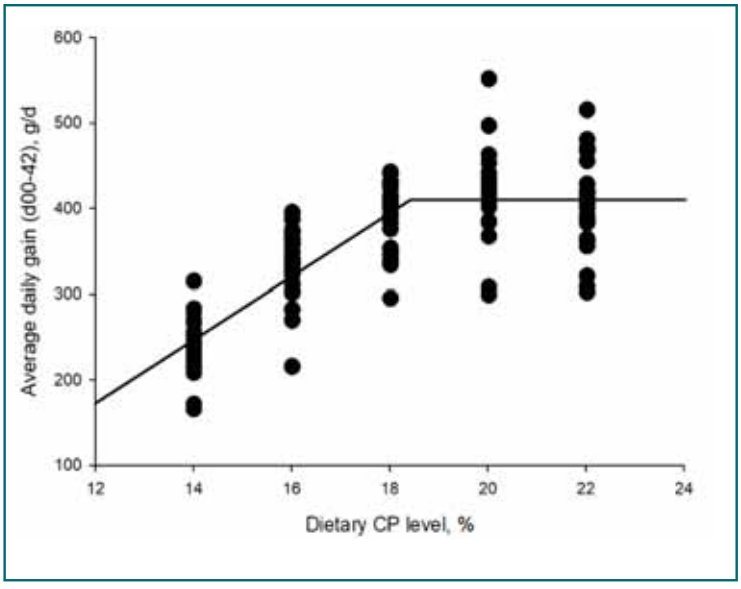

Figure 1. Linear breakpoint model used to determine the optimal CP inclusion concentration.

from 6% in piglets fed the 18% CP diet to 29% and 30% in the groups fed 20% and 22% CP respectively (Figure 2). At 18%, both the incidence of diarrhea and total feed cost could be reduced, making swine production more economically and environmentally sustainable

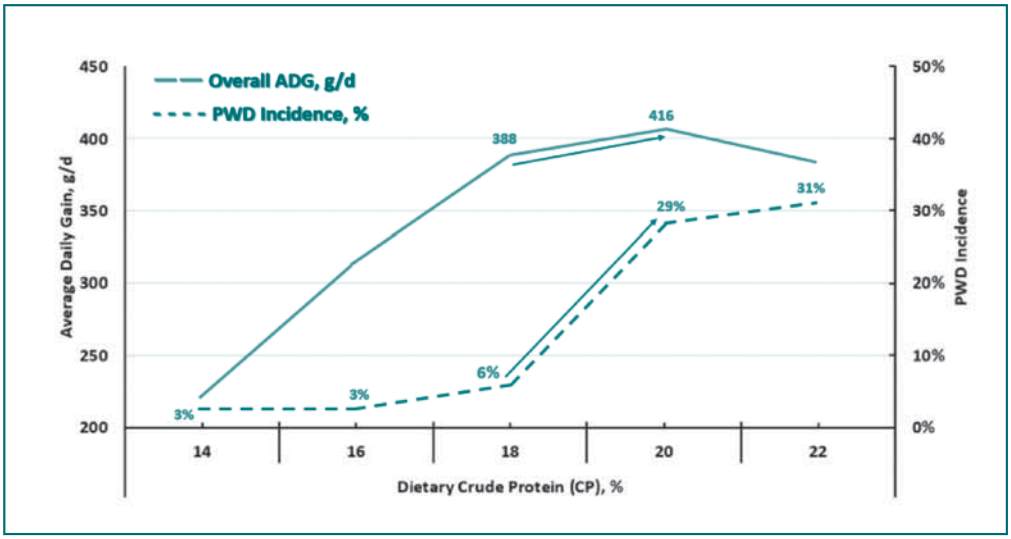

Figure 2. Comparison of overall ADG and PWD incidence at different levels of CP inclusion.

Next steps

Moving forward, studies related to EAA balance and CP inclusion are planned. Investigation into the essential-to-total nitrogen (N) ratio (E:T) is also planned, with intent to assess a number of diets representing a titration of NRC nitrogen requirements. Further, assessment of novel N sources has also been suggested, along with comparison of protein and non-protein N sources. Upon completion of dietary optimization trials, we hope to assess the impact of the diet in 'clean' and 'dirty' environments to determine if there is any protective value.

Implications

This study clearly exhibited the influence of CP inclusion on both growth performance and PWD. Though piglets fed diets containing 20% CP displayed better growth performance than those fed 18% CP, they also experienced diarrhea to a greater extent than piglets fed lower CP concentrations. Piglets fed the highest concentration diet (22% CP) also experienced PWD to a greater extent. Understanding how dietary composition can impact the incidence of disease is important to the sustainability of our industry, and will help reduce the use of antibiotics and other feed additives such as zinc oxide. Lowering CP inclusion may also reduce nitrogen excretion, supporting environmental sustainability. Optimizing dietary CP concentrations is also financially beneficial, as it can reduce feed costs and losses associated with PWD.