Feed ingredients play a role in effectiveness of medicated feeds, research shows

In the short-term, measuring water-holding capacity can provide a quick screening test to identify the feedstuff most compatible with the medication being added By Lilian Schaer

HOG FARMERS AREN'T ALWAYS getting full bang for their buck when it comes to medication given to pigs through feed. There's variability in how swine medicines fed via premixes interact with other feedstuffs in the pigs' diets - and it has impact on animal health, the environment and farmer profitability.

That's the conclusion of a recent research study completed by Prof. Jerome del Castillo, Associate Professor in the Department of Veterinary Biomedical Science at the Université de Montréal.

Pigs have a much lower oral drug bioavailability - the percentage of the dosage of a medication pigs consume through feed or water that is actually absorbed by their bodies - than humans or companion animals. Unknown to date has been why that is the case, even though there are many similarities between the gastrointestinal systems of pigs and humans.

According to Del Castillo, this matters because medication not absorbed by the animals is wasted, affecting length and cost of treatments as well as animal health and welfare. And unabsorbed medications leave the animal through their manure and have the potential to impact antimicrobial resistance in the liquid manure tank and on the soil where the manure is applied.

He suspected some kind of interaction with the medication that hinders its release inside the gastrointestinal tract, and that water availability was the limiting factor. Drugs administered through the diet are mixed with other feedstuffs, so the water needed for dissolving and releasing the medication was actually being soaked up by the feed particles instead of being available for the drugs.

To test his hypothesis, Del Castillo evaluated five major feed ingredients and two drug premixes approved for use in Canadian swine diets. The first step was to determine the water-holding capacity of each feed ingredient - soybean meal, corn, rye, wheat, dried distillers' grains with solubles (DDGS), and meat-and-bone meal - using both water and simulated gastric fluid. This included looking at the impact of soaking time, as well as particle size.

He then looked at how quickly the drug premixes - chlortetracycline and lincomycin - dissolved in the simulated gastric fluid, both on their own and mixed together with each of the five feed ingredients, and whether pH levels impact the rate of dissolution.

"Premixes used in livestock feed are currently not tested together with feedstuffs as it has long been assumed that the feed itself has no effect affect on drug dissolution," he says. "So what we are doing is new, something that has not been considered to date in the industry."

The study found that water-holding capacity varied significantly across the five feed ingredients with soybean meal absorbing the most amount of water and rye the least. The impact of particle size also varied depending on the feed ingredient.

When looking at drug dissolution, results showed that the drug premixes on their own dissolved completely, but when mixed with feed ingredients, only 41 to 83% of chlortetracycline and 58 to 83% of lincomycin were dissolved.

According to Del Castillo, the lowest dissolution rates were caused by soybean meal and corn, with rye and DDGS recording the highest dissolution. Soaking time, and the water-holding capacity and ash content of the feed ingredients significantly predicted the rate and extent of drug dissolution.

"Depending on the medication and how feed was manufactured, producers could be getting just a fraction of the medicine's effect that they are paying for, because what is not dissolved goes through the intestines and is eliminated in the feces," he says.

He advises producers to pay close attention to the composition of the medicated feed they are using. That means not just the nutritional values but also the specific feedstuffs being used as nutritionists only guarantee the nutritional content of the feed (energy, crude protein, fiber, ash, etc.).

In the short-term, measuring water-holding capacity can provide the swine industry with a quick screening test to identify the feedstuff most compatible with the medication being added to the feed.

Long-term, Del Castillo's goal is to develop a testing solution that pharmaceutical companies can use to develop better premixes with more consistent drug release and less feed ingredient interaction, although this will require more broad industry investment and support.

His hope is to continue this line of research by investigating feedstuff-drug interactions for medications provided through water. Although the drugs are dissolved when they are consumed by the animals, the pigs usually consume water when their stomachs are full of feed, which could impact how well drugs are absorbed in the gastrointestinal tract.

As well, he wants to test what impact replacing some or all of the corn or soy in a ration with alternative ingredients like rye or DDGS will have on how well pigs can absorb medicated feed. This will also help determine how applicable the findings are to feeding at different stages of a pig's life.

"Alternative feedstuffs could offer a precision feeding approach that could provide an economical and sustainable way to restore the efficacy of the medications," he says.

The project was funded by Ontario Pork. F. Ménard Inc. provided support in the form of feed and drug premix samples and nutrient composition testing.

This article is provided by Livestock Research Innovation Corporation as part of LRIC's ongoing efforts to report on Canadian livestock research developments and outcomes.