



Biological roles and efficacy of alkaline phosphatases (AP) for improving gut health, growth performance, physiological endpoints and gut microbiome in the weanling pig

Ming Z. Fan, University of Guelph

Why is this project important?

The experience of pork producers in the European Union has demonstrated that a ban on in-feed antibiotics as growth promoters did not fundamentally eliminate antimicrobial resistance concerns. This was because the use of antibiotics as a treatment during disease outbreaks had actually increased in food animal production. The effectiveness of current strategies to replace the use of therapeutic antimicrobials as a method to improve food animal gut health and production performance is generally inconsistent and limited worldwide. Consequently, a novel and disruptive biological approach, which resolves the root cause of gut health concerns, is needed to replace therapeutic antimicrobial use in food animal production and minimize the threat of antimicrobial resistance to public health and environment.

What will researchers do?

- Examine dietary and physiological factors affecting functionality and deficiency of porcine gut alkaline phosphatases (AP).
- Study the effectiveness of dietary supplemental AP for improving gut health and growth performance - without using therapeutic antimicrobials - in weanling pigs fed on typical Eastern and Western Canada weanling pig diets.
- Investigate the effect of dietary supplementation of AP on responses in the intestinal and fecal microbiota, and related functions, in weanling pigs.

What will be the benefit of this research?

The results of this project will contribute to the development of an effective and affordable antibiotic alternative to improve weanling pig productivity and reduce overall costs of swine production.

Also, while Canada and the US have banned the over-the-counter use of antimicrobials as growth promoters, the sustainability of the pork industry may be challenged by the continued use of therapeutic antimicrobials to maintain pig gut health. Most of the pork produced in Canada is destined for

the export market, and there is an increasing demand antimicrobial-free pork. Given the demand, the current trend in the swine industry is to minimize or eliminate the use of therapeutic antimicrobials. It is important for the Canadian pork industry to develop alternatives to these antimicrobials to stay competitive on a global scale and address the threat of antimicrobial resistance to public health and the environment.

What has been done so far?

As of 2021: Scientists are currently examining whether therapeutic antimicrobial use could significantly improve fat, starch and total dietary fibre digestibility values in weanling pigs.

They have also completed in vivo efficacy studies with weanling pigs and found that this exo-AP could greatly improve growth performance and gut health endpoints in weanling pigs without using therapeutic antimicrobials.

This exo-AP has been scaled up at the commercial fermentation level and post-fermentation processing in collaboration with the project's industrial partner.

The steps necessary for this exo-AP enzyme technology to be authorized by CFIA's Feed Division, and be made commercially available in Canada, are in progress, including steps towards patenting.

Collaborators

Tania Archbold
Robert Friendship
Min Wang
Weijun Wang

University of Guelph

Project status

Currently in progress.
Results expected in 2023.

Additional resources and information about this project

Peer-reviewed articles and abstracts

- Yin, X., Wang, W., Archbold, T., Burello, N., Scolaro, M., Zhou, K., Fan, M.Z. (2018, December 7). Genomic determinants of alkaline phosphatase catalytic affinity along the intestinal longitudinal axis of weanling pigs. Abstract and Poster Presented. *Journal of Animal Science*, 96. pp. 186-187.
<https://doi.org/10.1093/jas/sky404.405>
- Yin, X., Archbold, T., Burello, N., Scolaro, M., Li, M., Wang, W., Zhou, K., Fan, M.Z. (2018, December 7). Increased intestinal alkaline phosphatase maximal activities mediate improvements in growth and gut health status in weanling pigs fed the antibiotic-supplemented diet. Abstract and Poster Presented. *Journal of Animal Science*, 96: pp. 181.
<https://doi.org/10.1093/jas/sky404.393>

Related subprojects

The work presented in this fact sheet is one of two subprojects that make up a larger, nation-wide and multi-institutional Swine Cluster 3 project titled: *Development of novel feed additives to replace antibiotics and promote pig gut health*. The two subprojects are as follows:

- [Biological roles and efficacy of alkaline phosphatases \(AP\) for improving gut health, growth performance, physiological endpoints and gut microbiome in the weanling pig](#) (*this fact sheet*)
- [Use of newly selected probiotic bacteria to control enteric infections and improve gut health and performance of piglets](#)

Financial support for this project

This project is part of the Swine Cluster 3 (2018-2023) research program, made possible through financial support from Agriculture and Agri-Food Canada's Canadian Agricultural Partnership, eight provincial pork producer organizations and over 30 industry partners. [Click here to learn more about the financial partners for Swine Cluster 3.](#)