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UNIVERSITEIT GENT

INVITATION PUBLIC DEFENSE

Tittle

How do you want to wean this?

Navigating the post-weaning gap through early-life interventions to support intestinal health of piglets.

Name

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Date

1rst October 2026

PROMOTORS

Prof. dr. Filip Van Immerseel
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Curriculum Vitae

Christina Mouchtoglou was born in Thessaloniki, Greece on the 3rd of June, 1993. In 2015, she obtained her bachelor's degree in Animal Production from Alexander Technological Educational Institute of Thessaloniki. She later moved to Belgium and went on to acquire her master's degree in Molecular Biology form KU Leuven in 2018. During her last year of the master's she did her thesis internship at the Institute of Tropical Medicine in Antwerp in which she then volunteered until March 2019 as a laboratory assistant. In November of 2020, she began her PhD at the Department of Pathobiology, Pharmacology and Zoological Medicine, in the Livestock Gut Health Team.

Christina is the author and co-author of publications in peer-reviewed journals and her work has been presented in international conferences.

Where?

The defense will take place on 1rst October 2026 at 16h30

Auditorium D

Faculty of Veterinary Medicine
Ghent University, Campus Merelbeke
Salisburylaan 133, Merelbeke

A reception will follow in the Museum of Morphology

How to attend?

If you would like to attend, please register before September 25th, by email to Christina.Mouchtoglou@UGent.be

Members of the Jury

Prof. dr. Mathias Devreese
Chairman of the Jury
Department of Pathobiology, Pharmacology and Zoological Medicine
Laboratory of Pharmacology and Toxicology
Faculty of Veterinary Medicine, UGent

Dr. Filip Boyen
Secretary of the Jury
Department of Pathobiology, Pharmacology and Zoological Medicine
Faculty of Veterinary Medicine, UGent

Prof. dr. Dominiek Maes
Department of Internal Medicine, Reproduction and Population Medicine
Faculty of Veterinary Medicine, UGent

Dr. Marijke Aluwé
Flanders Research Institute for Agriculture, Fisheries and Food

Prof.dr. Massimo Marzorati
Prodigest

Summary

During the course of a piglet's life, the animal will undergo many changes, with weaning being one of the most stressful. Specifically, weaning is the transition from mother's milk to exclusively consuming solid feed. In nature, this process takes place between 12 and 17 weeks of age. During this period, the piglet's gut matures to efficiently digest solid feed. Under commercial conditions however, weaning typically occurs between 3 and 4 weeks of age in Europe, or as early as 19 days in other parts of the world. As a consequence, the piglet's immune system and gastrointestinal tract have not yet fully matured, leaving the young animal susceptible to dysbiosis and the development of diarrhoea due to the stress of a changing environment, a sudden switch in diet, and exposure to pathogens.

At a young age, piglets are not equipped to deal with the major, sudden changes that transpire during weaning. For this reason, we aimed to better understand how early weaning affects piglet's intestinal health.

Initially, we investigated the changes brought forth by early weaning by assessing developmental trajectories. To do this, we examined piglets weaned at 3 weeks of age and compared them to suckling piglets until those too were weaned. Additionally, we looked closely at immediate weaning responses (i.e. 1 and 4 days post-weaning) between two different weaning groups (3 vs 5 weeks). Our work in **Chapter 4** revealed that, regardless of weaning age, morphological and gene expression parameters were both affected after weaning. Interestingly, late-weaned piglets exhibited higher antimicrobial defense mechanisms compared to early-weaned piglets. Furthermore, distinct changes in the structure of gut microbiota were observed in the two groups, with age and weaning both influencing diversity. Early weaned piglets exhibited the most extensive reorganization of gut microbiota in the immediate post-weaning days. Based on these results, early-weaned piglets require compensatory physiological adjustments, whereas later-weaned animals appear to have a smoother recovery time and a more mature gastrointestinal tract.

Secondly, we looked into whether creep feed could induce positive changes on the same parameters examined in the weaning age trial. Creep feed is given to suckling piglets to familiarize them with solid feed. The goal is to prepare their gut microbiota to better digest plant-derived nutrients. In the study presented in **Chapter 5**, we provided creep feed to piglets from one day after birth until weaning at three weeks of age. Time post-weaning was the main driver of the differences observed in jejunal morphology, mucosal cytokine expression, barrier gene expression, and microbial diversity. Creep feed, however, did modulate intestinal alkaline phosphatase (IAP) expression, while exploratory analysis indicated a transient increase in GLP-2 expression that occurred on the same days when microbiota shifts were noticed.

Finally, we demonstrated that creep feed can actively reshape early microbial succession: it altered the seeding pattern of specific genera one and four days post-weaning, targeting the exact window of peak disease susceptibility. Even though these changes did not last, they occurred during the post-weaning window where the animal is most susceptible to disease. Additionally, more studies with bigger cohorts and more sampling timepoints pre-weaning are needed to ascertain if the priming effect of creep feed results in measurable benefits on intestinal health.

For many years, farmers benefited from the numerous effects of zinc oxide (ZnO) to help prevent post-weaning diarrhoea (PWD) and support piglet growth. However, Europe banned the medicinal use of ZnO due to environmental concerns as well as risk of (co)-selection of antibiotic-resistant bacteria. Given this reason, we investigated whether berberine could be a suitable replacement for ZnO. Berberine is an isoquinoline alkaloid found in plants such as Coptis chinensis and various Berberis species. It has been used for decades in Chinese medicine and is well-known for its anti-diarrhoeal properties. Apart from berberine itself, its metabolites are also recognised as important contributors to its beneficial actions. Therefore, **Chapter 6** focused on how berberine was metabolized in weaned piglet's blood and intestine. At a low dose (30 mg berberine/kg feed), berberine was not able to significantly affect small intestinal morphology, SCFA production, or the gut microbiota in unchallenged weaned piglets. When taking a closer look at its metabolism, thalifendine (a phase I metabolite) and glucuronide conjugates of phase I metabolites were the predominant metabolites in plasma. Berberine was present in all intestinal compartments alongside phase I metabolites, showing increasing concentrations from the proximal to the distal segment. Further studies are warranted to determine the optimal dose of berberine without negatively influencing gut microbiota composition, as well as whether its beneficial effects are more pronounced under a diseased or unchallenged state.

In conclusion, our results show that acute responses to weaning will always occur regardless of weaning age, but that later-weaned animals appear to be more resilient through a more stable gut microbiota and sustained innate defenses. Furthermore, creep feed could potentially help piglets by promoting beneficial bacteria during the vulnerable post-weaning window when they are most susceptible. Moreover, we were able to show for the first time how berberine is metabolised in weaned piglets throughout the small and large intestine, as well as in the plasma.