UNIVERSITY of GUELPH

ONTARIO AGRICULTURAL COLLEGE

DEPARTMENT OF ANIMAL BIOSCIENCES

PhD. Defence

Effect of *Lactobacillus* bacteria on feather pecking behaviour and related physiological pathways

Claire Mindus

Date: September 7th 2021 at 10:00am

The PhD Defence for Claire Mindus has been scheduled for September 7th, 2021 at 10:00am. The defence will be held online via Teams: https://teams.microsoft.com/l/meetup-join/19%3ameeting_YzI3ZTJhYWEtZjgzOC00ODg3LThjZmItZTVhOGY1MTQ2Njc5%40thread.v2/0?context=%7b%22Tid%22%3a%22be62a12b-2cad-49a1-a5fa-85f4f3156a7d%22%2c%22Oid%22%3a%

The exam committee will consist of:

Examining Chair: Dr. Wendy Pearson

Advisor: Dr. Alexandra Harlander

Adv. Committee Member: Dr. Anna-Kate Shoveller

Additional Graduate Member: Dr. Tina Widowski

External Examiner: Prof. Ute Knierim

Abstract:

The gut microbiota is a key regulator of the neuroimmune and neuroendocrine communication pathways of the brain-gut-microbiota axis. Disruption of the microbiome can lead to deterioration in gastrointestinal, neuroendocrine, immune functioning and may even contribute to the etiology and course of some psychiatric disorders. Some enteric gut bacteria, such as *Lactobacillus* species, have demonstrable beneficial effects on health and disease. Consequently, these organisms are used as probiotic supplements.

Severe feather pecking (SFP) is a behaviour performed by laying hens which can lead to significant health and welfare issues. It remains one of the most challenging welfare and economic issues in the egg industry. Previous hypotheses of the causes of SFP considered external factors such as poor housing conditions as SFP triggers; however, ethology alone cannot fully explain this behaviour. Instead, birds displaying SFP also display distinct physiological characteristics relevant to an altered gut-brain microbiota axis. This includes differences in microbiota composition, namely a *Lactobacillus*-depleted gut microbiota and microbial metabolites. a more responsive immune system and an altered aromatic amino acids metabolism.

The objectives of this thesis were to assess the impact of a single-strain probiotic (*Lactobacillus rhamnosus* JB-1) supplementation on SFP behaviour, microbiota composition, T cell subpopulations and metabolism of aromatic amino acids in birds. To achieve this, diverse supplementation techniques were evaluated at various stages of life and in different genetic lines of bird under stressful or control situations. Disrupting social structures, restraining birds and/or removing basic housing structures were utilized to create an industry-like stressful environment.

The results of this thesis suggest that therapeutic supplementation with *Lactobacillus rhamnosus* JB-1 is a promising tool, which reduces FP and feather damage, stress-induced cecal microbiota dysbiosis and, leads to a strong immunological effect characterized by T cell production in laying hens. Further research should investigate the impact of *Lactobacillus* supplementation in commercial farm settings.

Heat stress can negatively affect the growth performance of lambs. Heat stress thresholds for Temperature-Humidity Index (THI), at which points the bodyweight begins to decline, were determined for weaning weight and post-weaning gain in lambs. Heat stress functions, modeling THI beyond the threshold, were used as the environmental gradient for heat stress to examine possible genotype by environment interaction, using a reaction norm model. The results confirmed genetic antagonism between growth traits and heat tolerance. Hence, this antagonism needs to be accounted for in potential breeding programs. Variation in heritability estimates across the heat stress gradient provides opportunity for selection for growth traits within specific environments.