UNIVERSITY of GUELPH

ONTARIO AGRICULTURAL COLLEGE

DEPARTMENT OF ANIMAL BIOSCIENCES

PhD. Defence

The effect of maternal fed omega-3 fatty acids on the cognition and fearfulness of their offspring: A study of broiler and egg-laying chickens

Rosie Whittle

Date: April 20th 2023 at 1:00pm

The PhD Defence for Rosie Whittle has been scheduled for April 20th, 2023 at 1:00pm. The defence will be held online via Teams and in 141: https://teams.microsoft.com/l/meetup-join/19%3ameeting_YmQ4YTIwNGUtZGNmYy00M2MzLWIzMmEtZDljMDNjODZlNjQx%40thread.v2/0?context=%7b%22Tid%22%3a%22be62a12b-2cad-49a1-a5fa-85f4f3156a7d%22%2c%22Oid%22%3a%22fbd28915-dda5-478f-8ecb-a3682dcf0c3a%22%7d

The exam committee will consist of:

Examining Chair: Dr. Lee-Anne Huber

Adv. Committee Member: Dr. Tina Widowski

Adv. Committee Member: Dr. Elijah Kiarie

Additional Graduate Member: Dr. Derek Haley

External Examiner: Dr. Richard Blatchford

Abstract:

Commercial poultry diets are deficient in omega-3 fatty acids (n-3 FA) that are essential for embryonic brain development. Feeding n-3 FA to broiler and layer breeder chickens may directly benefit them and could increase the health, welfare, and productivity of their offspring. The aim of this thesis was to assess the effects of maternal feeding n-3 FA on the brain size and n-3 FA concentration, cognition, and fearfulness of layer and broiler offspring. Ross 708 broiler breeders were fed a control (n-6 to n-3 ratio 26.1:1) or flaxseed (4.81:1) diet during the rearing and laying period, resulting in four maternal diet combinations (control-control, control-flaxseed, flaxseed-control, flaxseed-flaxseed). Two strains of layer breeders, ISA Brown and Shaver White, were also fed a control (7.56:1) or flaxseed (5.31:1) diet. Layer and broiler offspring were assessed for brain size and docosahexaenoic acid (DHA) concentration, performance in two types of learning tests (T-maze and discrimination tasks) and fear response to a novel object and social isolation. Although maternal feeding of n-3 supplemented diets resulted in significantly greater brain: body weight ratios in broiler offspring and tended to increase brain DHA concentration in layer offspring, we found little evidence that maternal flaxseed diets resulted in differences in offspring cognition or fearfulness. There were sex-specific effects of maternal diet on broiler offspring vocalisation rate during a social isolation test and participation in a T-maze test. However, no effect of maternal diet was found on layer offspring behaviour. We found several effects of strain on behaviour in the layers. White chickens participated more in T-maze tests as chicks and were more likely to reach the learning criteria in both a T-maze test and discrimination learning task when tested as pullets and adults. Brown chicks vocalised more during social isolation, whereas white chicks spent more time motionless. a novel object test, brown chickens were observed more frequently on elevated platforms than white chickens indicating greater avoidance of the novel object. We suggest further exploration into the optimal n-6 to -3 ratios for poultry diets using diets closer to the 1:1 ratio found in wild precocial birds.