Overview of Key Topics in Poultry Science

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What I did

As part of my summer 2021 co-op work term I joined the Dr. Anna Rogiewicz' s research group at University of Manitoba's Department of Animal Science. While participating in the research in the Nutritional Biochemistry Laboratory I learned about the various aspects of poultry science through learning lab techniques, attending presentations and seminars, taking part in an animal study, and reviewing literature. The purpose of this presentation is to summarise the things I had the pleasure of learning.

Nutritional Analysis

Wet chemistry is a key component of the study of poultry nutrition. These methods allow animal scientists to assess the nutritional content of animal feed which can in turn be used to:

- Provide a well-balanced, healthy diet that would fulfill the nutrient requirements for the animals
- Maximize the growth, health and productivity of the animals
- Reduce costs of feed through efficient use of nutrition
- Perform quality control of the feed[11]

However, since many of wet chemistry procedures can be time consuming and expensive, alternatives which allow for the analyses to be performed faster and at a reduced cost are highly desirable.

Near infrared reflectance spectroscopy (NIRS) is one such alternative. NIRS can detect and quantify nutrients by identifying vibration patterns of bonds between hydrogen and other constituent atoms of organic molecules.[2] This method does not fully replace wet chemistry as the traditional procedures are still necessary for the calibration of the instrument, however this process is non-destructive, so the sample can be reused for other purposes or examined again.[11] NIRS is also rapid, able to provide results within minutes, greatly increasing the number of samples that can be processed within a given time compared to wet chemistry.

Gas chromatography is one more method used for nutritional analysis. In the Nutritional Biochemistry Laboratory it is used to determine fiber components of feeds (non-starch polysaccharides, oligosaccharides, sugars) and glucosinolates in feed. Glucosinolates are anti-nutritional factors present in cabbage-family plants, including canola and can impair liver and kidney function, reduce growth performance, and interfere with thyroid hormones.[5] As such it is important to monitor and analyze the amount of glucosinolates present in canola-derived feeds.

Gut microbiota

Poultry gut microbiota is a growing field of study within animal science. Gut microbiota is important to the overall health of poultry as it can have the following effects:

- Prevent pathogen adhesion and toxin production
- Promote adaptive immune response
- Induce the production of anti-microbial peptides by the innate immune system[4]

Gut microbiota has also been shown to affect metabolism. It impacts nutrient absorption and energy harvesting. Gut bacteria also produce short chain fatty acids which is an additional source of energy. Vitamins, including the B family of vitamins and vitamin K are also produced by the microbiome.[4, 13]

Due to all these effects, examining poultry gut microbiome can be very advantageous. These are some of the aspects currently being studied:

- Microbiome composition
- Diversity and richness of microorganisms present
- Effects of antibiotics and probiotics
- Relationship to nutrient digestibility, growth and performance
- Impact on innate and adaptive immunity, immunomodulation, and auto-immunity
- Establishment of the microbiome[13]

Poultry can also be potentially used as an animal model to guide the study of gut microbiomes in humans, as animal models have historically taken a crucial role in health sciences.[1]

Biosecurity

In order to maintain both the health of poultry and food safety, as well as to prevent zoonosis, it is important for the poultry industry and poultry researchers to follow a biosecurity program informed by knowledge from the field of animal science. The purpose of such program is to prevent exposure of animals to pathogens and decrease the likelihood of pathogen spread if exposure does occur.[3]

Many potential routes of exposure are considered and strategies to minimize risk are implemented. In the past prophylactic use of antibiotics was common but is being phased out or outright banned in some countries due to the rise in antibiotic resistant bacteria[3] and other strategies are now preferred. The planning and building of farms aim to isolate the poultry from surrounding wildlife and plans are put in place for pest control. Workers dress in clean protective equipment including boot covers and gowns to avoid bringing in pathogens on clothing and access is restricted to authorized personnel. Tools and transport vehicles are thoroughly sanitized. Workers are trained and observe animals for any potential issues. Animals are vaccinated both against pathogens which pose a risk to them and more recently, against pathogens causing food safety issues.[3, 9, 12]

A student examines a chick at the Small Animal Research Facility, University of Manitoba

Sustainability

With the help of animal science, there are many avenues for utilization of byproducts of other industries in poultry production. For example, in dry mill ethanol production grain starches are fermented and distilled to ethanol for use as a biofuel. The remaining byproduct of this process, distillers dried grains with solubles (DDGS), is rich in protein, amino acids, and phosphorus.[10] As such it has been incorporated into poultry diets, reducing the need for use of inorganic phosphorus.[14] Inorganic phosphorus is obtained in through open pit mining of phosphate, a process known to release toxic metals into the environment[8], making DDGS a more sustainable alternative.

Canola meal is another example. Canola meal are the remaining solids after canola oil is extracted from the seeds. Poultry production is an excellent candidate for utilization of the resulting meal due to the amino acid profile being suited to poultry diet.[7] Since canola oil production in Canada is continuing to grow to record heights[6] it is also economically advantageous that the byproduct can be used by the poultry industry.

Determination of the chemical composition and nutritive value of these alternative protein sources for poultry would allow for their effective use in poultry and swine diets.

Canola flowers in crop at Wallendbeen, NSW. by CSIRO, licensed under CC BY 3.0

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