THEY GOT IT FROM THEIR MOMMA: How Developmental Programming is Changing the Poultry Industry

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Developmental programming has the greatest application potential for modern poultry production as a strategy to meet the demands associated with an ever-changing global market. Although the industry has seen significant advancements over the years, many of the conventional management systems have become obsolete in this new world of food production. It's time for the industry to move towards a new 21st century vision of the poultry industry that encompasses all stages of production and an understanding of the lasting effects one stage can have on the next.

Developmental programming refers to the ability of specific exposures during pre- and early-life to impact epigenetic mechanisms resulting in lasting physiological, developmental, and immunological changes. As a single example, access or denial of

specific nutrients during critical stages of development can have profound effects on the production potential and health of birds. Understanding the implications of these exposures could provide a valuable tool towards ensuring sustainability of the industry.

In the broiler industry, advancements in genetic and nutritional sciences have resulted in a modern broiler bird that reaches market weight at a significantly younger age. To put it into perspective, approximately 40% of a meat-bird's total life is spent within the egg(1). This means, there is a limited window of opportunity for producers to address any immunological challenges that could threaten production efficiency post-hatch. Combine this with the increasing pressures for reduced on-farm treatments and growing desire for alternative housing systems, we see the sustainability of the industry becoming compromised. Therefore, it is critical for the poultry industry to begin applying pre-hatch strategies to produce robust chicks that can meet their genetic production potential.

The fatty acid composition of the broiler breeder diets is an area of great opportunity for developmental programming. Dietary fat sources represent a critical nutrient for developing embryos as it represents over 30% of the yolk(2) Furthermore, the fatty acid composition of the yolk fat is greatly influenced by the maternal diet consumed by the breeder bird.

As an example, research has demonstrated that feeding breeder broiler birds a diet with higher levels of omega-3 fatty acids altered the cell-mediated immune response in progeny chicks and reduced inflammation(3) This lasting change from early-life nutrient exposure is suggested to allow more energy to be available for production purposes. Interestingly, this response persisted for up to 21-days post-hatch as the birds continue to utilize the maternal nutrients through their abdominal yolk-sac.

Dr. Elijah Kiarie and a team of researchers from the University of Guelph are taking a closer look into fatty acid nutrition and its application of developmental programming in poultry production systems. According to Dr. Kiarie, "Omega-3 fatty acids are known to play critical roles in the regulation of a variety of biological processes including development of vital organs such as skeleton, brain, gastrointestinal and engender transgenerational effects on development and behavior."

The ambitious research initiative will evaluate the impact of various feeding programs for breeder stock and their progeny that include the commercially available, omega-3 feed ingredient known as linPRO. Variables including reproductive efficiency of breeder birds, the resulting embryonic development at the hatchery along with the subsequent health, performance, carcass quality, skeletal development and overall robustness of the progeny will all be measured.

Dr. Kiarie believes the knowledge gained from this research will help advance the industry. "The embryo to neonate transition is a critical period of development in poultry in which important genetic programs governing metabolism and growth are established. The potential of omega-3 fatty acids in stimulating bone, brain, and immune cells development

at embryonic through to early phases of chicks could significantly improve poultry productivity and welfare."

Preliminary results already show promise for the application of an omega-3 developmental feeding program for pullet breeder flocks. ***Dr. Kiarie explains that "Our study evaluated the effects of maternal and post-hatch dietary offering of linPRO on skeletal development in pullets and found that pullets from breeder stock fed linPRO had more tibia ash weight and stronger tibia than pullets from the control breeder group."***Dr. Kiarie goes on to state that "these findings demonstrated effectiveness of maternal and post-hatch feeding of omega-3 fatty acids in support of skeletal strength in young pullets which can greatly reduce poor egg shell quality and skeletal maladies seen in laying hens across all housing types."

Dr. Kiarie also highlights promising initial data compiled on broiler breeder stock. "Data compiled on broiler birds suggests potential to improve breast yield in the progeny when linPRO is introduced during both the breeder diet and in post-hatch diets."

Dr. Kiarie and his team will be presenting their findings within the coming months at the upcoming Animal Nutrition Conference of Canada (ANCC, May, 2019; Niagara Falls, ON) as well as the Poultry Science Association Meetings (PSA, July, 2019; Montreal, QC).

Janna Moats, MSC., PAg, Technical Services Manager

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