

Completed Research

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Project #F015

Impact of Incubation/Hatcher Temperature on Performance and Immune Function of Selected Lines of Commercial Broilers

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"Effects of Incubator/Hatcher Temperatures on Two Lines of Broilers"

Problem: As the embryonic incubation and peri-hatch periods of commercial high-yield broiler strains continue to encompass relatively larger portions of the life of the bird, the incubator, hatcher, and post-hatch environments become increasingly important. The current situation in commercial incubation has resulted in increased metabolic heat production by the embryos that leads to a buildup of heat in the setters and hatchers, particularly in the latter phases of development, that is difficult to dispose of due to poor airflow. As a result, hatch of fertiles has decreased and more problems with embryonic development have become challenges for hatchery management. The elevated temperatures may cause stress to the developing embryo, alter development, and result in poor chick quality and post-hatch performance.

Proposal Objectives: The objectives of the proposal were to determine the effect of embryonic incubation/hatcher temperatures on broiler chick intestinal development and early immunity based on measurements of:

1. Hatch and performance parameters
2. Morphological development and maturation of the intestine
3. Lymphoid organ development and antibody responses

Results Achieved for Objectives:

1. No significant differences resulting from incubation temperature were observed in performance parameters (body weight, body weight gain, feed conversion or mortality) on the final growout day for either breed (Cobb or Ross). There were early post-hatch body weight differences, but these did not persist to the final phases of growout. However, stress (temperature and oxygen) during transport of the chicks did result in lower body weights as compared to transport without stress. Hatch was significantly lower for embryos incubated at a combination of early low and late standard temperature.
2. Incubation temperature profiles resulted in significant alterations in intestinal development. Differences were observed in tissue structure (villus height and crypt depth), rate of tissue development, yolk utilization, expression of nutrient transporters, and goblet cell numbers.
3. The weight of immune organs was influenced by alterations in incubation temperatures early post-hatch, but these differences did not persist later in life. Antibody titers to sheep red blood cells were altered by interaction of incubation temperatures and post-hatch transportation stress.

Summaries of completed projects are available at www.poultryegg.org.

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Impact of Research for Industry: These studies present for the first time the effects of altered embryonic incubation temperature and stress during transportation of newly hatched chicks, on small intestine morphology, digestive and immune organ development, and immune response in broiler chicks. The data indicates that temperature deviation from 99F, either low in early development or high in late development, alone or in combination with transportation stress can have a detrimental impacts on intestinal development and immune responsiveness, which compromises genetic potential of the bird and can result in decreased economic profits for commercial poultry producers. While not examined in these studies, the impact on performance and immune competency would likely be even greater in a commercial setting with potential exposure to challenges in the environment and more variation in management.

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