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Multicriterion analysis of embryo acclimation techniques aiming at improving adaptive capacities in broiler chickens

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It is possible to improve poultry adaptive capacities towards changes in ambient temperature by exposing eggs to specific incubation temperature and relative humidity. Exposure of eggs for periods of 30 min. at 15°C at the end of incubation (vs. 37.8°C in standard incubation) was shown to limit the incidence of ascites in chickens subsequently exposed to cold. In the context of climate change that could increase the frequency of extreme climatic events, and of the depletion of non-renewable energy resources necessary to heat farm buildings, our goal was to improve chicken robustness and to achieve a multicriterion assessment (growth, health, production costs, welfare, meat quality ...) of the cold incubation technique depending on subsequent rearing conditions of chicks.

In a first study, we tested incubation conditions suitable for embryonic cold acclimation of broiler chickens. The tested incubation conditions were a standard egg incubation (control IT), two acute cold exposures at 15°C at the end of incubation (IA1) or cyclic decreases in incubation temperature (36.7°C vs. 37.7°C for 6h/day for days 10-18 of embryogenesis, IA2). After hatching, chicks were reared in either control conditions (ET) or submitted to day/night variations in room temperature (EFC cyclical cold rearing) or to continuously lower ambient temperatures requiring broiler adaptation (cold rearing EF). A first experiment took place in cages to allow the individual measurement of feed consumption, followed by a second experiment in floor pens.

In our conditions, the cold incubation techniques did not affect egg hatchability. IA2 incubation (cyclic cold) degraded growth and feed consumption ratio in females reared in cages, while IA1 treatment (two rapid exposure to 15°C) was rather beneficial for growth performance. This was confirmed by the floor pen trials, where IA1 females had better starting performance and growth as compared to their controls IT, but only in standard rearing conditions ET. In males, the embryonic cold acclimation IA1 also seemed favorable, but for animals started in cold EF conditions only. Multi-criterion analysis on the floor trial data measured in floor pens is currently focused on the responses of broilers acute cold incubation IA1 or standard incubation conditions (IT) in interaction with postnatal rearing conditions. This analysis integrates economic (competitiveness, consumer expectations...), environmental (contribution to climate

change, non-renewable energy consumption...) and social (welfare and animal health, product quality...). First results point to a decrease in gas use for heating (-11%) but slightly higher litter mass when starting chicks at 28°C. Interactions were found between incubation conditions and postnatal ambient temperature on performance and meat quality at slaughter age.

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Keywords: Broilers, Cold embryo acclimation, Adaptability, Robustness, Thermotolerance, Multicriterion analysis
