Cyclically cold incubation temperatures durably affect anti-oxidant pathways and the regulation of energy metabolism in broiler chickens.

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Cyclically cold incubation temperatures improve the resistance of broiler chickens to ascites, yet the underlying mechanisms are not known. 900 eggs obtained from 48 week old Ross broiler breeders were assigned to the following incubation treatments: Control I eggs were incubated at 37.6°C, while Cold I eggs experienced reduced incubation temperature of 36.6°C for 6 h/d from d 10 to 18 of incubation. Chickens were then reared at standard temperatures or under cold exposure, that was either or not associated with a postnatal cold acclimation at d 5 post-hatch. Hepatic catalase activity and malondialdehyde content were measured at hatch. Serum thyroid hormone and triglyceride concentrations, and muscle expression of some genes controlling energy metabolism and oxidative stress were also measured at hatch and at 5 and 25 d posthatch. Cold incubation altered anti-oxidant pathways with higher catalase activity, but lower expression of avian uncoupling protein (UCP3) at hatch. Yet, long-term enhancement in the expression of avian UCP3 was observed, probably caused by an increase in the expression of the transcription factor PGC-1α. An increase in serum T3 concentration was observed only in chickens exposed to both cold incubation and later acclimation at 5 d with cold rearing. Our results suggest that cyclically cold incubation can result in long-term changes in anti-oxidant pathways and energy metabolism, which could improve the health of chickens reared under cold conditions.