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Long-lasting effects of thermal manipulations during embryogenesis in broiler chickens

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Climate change may affect animal physiology, having deleterious consequences for poultry farms. Thermal manipulation (TM) during embryogenesis has been shown to improve heat acclimation in the long term in broiler chickens. TM consists of increasing cyclically incubation temperature from 37.8 °C to 39.5 °C from day (d) 7 to d16 of embryogenesis. Our study aimed to determine the effects of TM and of a subsequent heat challenge (HC) on chickens performance, physiology and metabolism, in order to better understand heat adaptation acclimation mechanisms. In our conditions, TM did not modify hatchability and performance until d28 post hatch, but slightly decreased body weight and composition at d34. TM decreased body temperature (bT) until d28 as well as plasma triiodothyronine concentrations. Our results suggest that TM changes respiratory physiology and decreases stress response during HC at d34. TM associated with low bT affected the expression of genes involved in muscle energy metabolism, or mitigated the effects of acute heat stress. The transcriptomic study performed on breast muscle also pointed out new pathways modified by TM in the long term regulating vascularization and epigenetic mechanisms. TM animals activated more genes in response to HC than controls, possibly explaining their better heat adaptation. This integrated study demonstrated that TM induced long term physiological and metabolic adaptations to changes in the thermal environment of chickens.

***In ovo* stimulation of the chicken embryo with synbiotics influences adult's molecular responses**

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Chicken embryo development takes place inside the egg and is influenced by the genetic background, composition of the egg yolk (e.g. nutrients and IgY antibodies deposited by the hen) and conditions during incubation (e.g. temperature and humidity). However, in ovo technology allows the supply of additional stimuli to the growing embryo to optimise conditions for embryonic and post-hatch growth and development. In commercial settings, the newly hatched chicks are kept in a sterile environment, separate from the adults. Therefore, the neonates are deprived of the stimuli needed for the development of a healthy intestinal microflora. With the properly selected combinations of pre- and probiotics (synbiotics) delivered in ovo, it is possible to modulate the optimal composition of the chicken intestinal microflora, fully developed at hatching. In this study we analyzed the immune-related gene expression regulation in adult broiler chickens (Cobb) that had been treated in ovo at 12th day of embryo development with different synbiotic combinations. Intestinal (jejunum, cecal tonsils) and splenic tissues were harvested at several time points post hatching (day: 1, 7, 14, 21, 35). Gene expression regulation was analyzed using RT-qPCR to determine the expression of the selected gene panel, including IL-4, IL-6, IL-8, IL-18, IL-12p40, cluster of differentiation (CD) 80, interferon-beta (IFN-β) and interferon-gamma (IFN-γ). Preliminary results indicate that in ovo modulation of the microbiome results in the response of the host at the molecular level. Results of this study will provide an insight into development of the host-microbiome relations throughout the chickens' lifespan in terms of molecular responses of the periphery of the immune system (spleen), intestine (jejunum) and the gut-associated lymphoid tissue (cecal tonsils) to in ovo delivered synbiotics. Acknowledgements: FP7-KBBE-2012-6-singlestage project from European Commission.