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Impacts of Early Thermal Manipulation on Gene Expressions at Hatch in Mule Duck

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Temperature changes during the embryogenesis are well known to modify either thermotolerance of broilers or hepatic metabolism in mule ducks. This study will focus on the impact of the temperature increase (+1°C, 16h/24, from embryonic day 13th to 27th) in mule ducks. We firstly analysed the direct impact of temperature changes during the embryogenesis. One hour after the increase of temperature, relative expressions of genes involved in lipid synthesis, thyroid and inflammation pathways were up-regulated. Heat shock proteins (HSPs) were also significantly stimulated by the thermal manipulation, with up and down regulations depending of the studied HSP gene. These genes were also significantly modified after days of temperature increase, confirming a direct regulation of gene expressions by the thermal manipulation. Indeed, lipid, inflammation, cell proliferation, thyroid and heat shock protein genes were up-regulated at the embryonic days 16th, 20th and 24th. Only gene involved in epigenetic mechanisms was down-regulated at the embryonic day 20th. In order to test if the thermal manipulation could have a permanent effect later in life, we also analysed gene expressions at hatch, this period corresponding to a critical period for the animals. In relation to the early thermal manipulation, animals presented lower weights at hatch but also lower gene expressions for genes linked to heat shock proteins and thyroid pathway. Moreover, genes involved in lipid metabolism and inflammation were up-regulated. Our results strongly suggest a long-term effect of the early thermal manipulation in ducks. Further studies are now in progress to understand the mechanisms of the observed programming in hatching ducks.

Keywords: Mule duck, thermal manipulation, gene expression, heat shock protein, metabolic programming