Effects of in-yolk-sac administration of carvacrol on cholesterol resorption from yolk residuals and physiological adaptive indicators in broiler chicks exposed to neonatal fasting

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Abstract. Three hundred and twenty Ross 308 male broiler chicks were used to examine effects of in-yolk-sac (IYS) administration of carvacrol on cholesterol resorption from yolk and physiological adaptive responses of broiler chicks subjected to post-hatch fasting periods of up to 72 h. Effects of the four experimental treatments, namely non-handled control (NHCON), sham injection control (SICON), polysorbate-80 injection (POLS), and carvacrol injection (CARV), were examined in 5 replicates of 10 birds each. Liver proportional weight was greater in carvacrol-injected chicks compared with other birds 24 h post-hatch ($P<0.05$). The mean blood glucose concentration was 199.0 mg dL$^{-1}$ when chicks were removed from the hatcher baskets, and decreased in all birds after being subjected to a 72 h post-hatch fasting. However, the slope of decrease in serum concentration of glucose was slower in carvacrol-injected birds than in the other birds, and they had a greater plasma glucose level compared with NHCON and SICON birds after 72 h post-hatch fasting. Lower plasma cholesterol levels were observed in carvacrol-treated chicks compared with those subjected to the other treatments at 72 h post-hatch ($P<0.05$). Blood concentration of calcium (Ca) was greater in carvacrol-injected birds at 24 h post-hatch than in NHCON and SICON birds ($P<0.05$), but at 72 h it significantly increased in all birds, with the exception of carvacrol-treated chicks, which had significantly lower blood Ca concentration (11.17 mg dL$^{-1}$) compared with other birds ($P<0.05$). Blood potassium concentration increased in polysorbate-80 and carvacrol-injected chicks 24 h post-hatch compared with the NHCON and SICON birds ($P<0.05$). In conclusion, the results of the current study revealed that there was no direct interaction between cholesterol and carvacrol leading to reduced cholesterol absorption from yolk sac in newly hatched broiler chicks.

1 Introduction

During the last two decades, phytogenic feed additives in animal nutrition have increasingly attracted attention regarding their potential role as alternatives to growth promoter antibiotics. Increasing demands for phyto-additives in poultry nutrition warrant further characterization of the effects of plant-derived active components on poultry metabolism. Hypolipidemic and hypocholesterolemic effects of medicinal plants derivations, particularly Labiatae family plants, have been previously reported (Jiang et al., 2003; Kaimal et al., 2010; El-Rokhel et al., 2010; Vijayaraj et al., 2011; Garcia, 2014; Saravanan and Ignacimuthu, 2015). However, the mode of action has not been fully investigated.

Direct interference of certain phytogenic active components on absorption of lipid constituents and cholesterol (Ostlund et al., 2003), reducing activity of liver enzymes involved in de novo fatty acids and cholesterol biosynthesis (Qureshi et al., 1983; Elson and Qureshi, 1995; Crowell, 1999), and inducing an increased ratio of anabolic to catabolic steroids (Khosravinia, 2015b) are the three suggested mechanisms for hypolipidemic and hypocholesterolemic effects of medicinal plants derivations. The current study revealed that there was no direct interaction between cholesterol and carvacrol leading to reduced cholesterol absorption from yolk sac in newly hatched broiler chicks.