

2nd International Conference on

Livestock Nutrition

July 21-22, 2016 Brisbane, Australia

Calcium deficiency suppresses follicle growth in laying ducks

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Calcium is very important for maintaining the bone growth and eggshell formation in laying birds. However, some of other biological functions of calcium in laying birds are scarcely known. The purpose of this study was to test the hypothesis that calcium may affect the follicle growth of laying ducks by employing calcium-deficient diet. 450 female ducks (*Anas platyrhynchos*) of 22 weeks were randomly assigned to 3 groups. Ducks were fed one of two calcium-deficient diets (containing 1.8% or 0.38% calcium, respectively) or a calcium-adequate control diet (containing 3.6% calcium) for 67 days (depletion period) and then ducks of the 3 groups were fed a calcium-adequate diet for an additional 67 days (repletion period). As compared with the calcium-adequate control, the hierarchical ovarian follicles number (diameter >1 cm) and total ovary weight of ducks that consumed the diet with 0.38% calcium was significantly decreased ($P<0.05$) during the depletion period, accompanied by reduced egg production. The mRNA expression of ovary gap junction protein, alpha 1 (*GJA1*), gamma 1 (*GJC1*), delta 2 (*GJD2*) were decreased after feeding calcium-deficient diets (1.8% or 0.38% calcium, $P<0.05$). Transcripts of estradiol receptor 2 (ER2), luteinizing hormone receptor (LHR) in ovary were reduced in the ducks fed 0.38% calcium or 1.8% calcium ($P<0.05$). While the mRNA expression of ovary follicle stimulating hormone receptor (FSHR) was decreased in the ducks fed 0.38% calcium but not the 1.8% calcium. The cAMP content in the ovary was increased by calcium depletion (the increase reached 6% for 1.8% calcium and 13% for 0.38% calcium, respectively). Plasma concentrations of estradiol, follicle stimulating hormone (FSH) and calcium was decreased by both of the calcium-deficient diets ($P<0.05$). The down-regulated gene expression of gap junction protein, hormone receptor, increased cAMP content as well as the suppressed follicle growth could be reversed by repletion of dietary calcium. The results of the present study suggest that dietary calcium deficiency negatively affects the follicle growth of laying ducks possibly by down-regulating follicle growth-related genes and hormones.

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