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Effects of the replacement of corn oil with linseed oil on fatty acid composition and the expression of lipogenic genes in broiler chickens

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The effect of dietary 18:2n-6/18:3n-3 ratio (by the replacement of corn oil with linseed oil) on n-3 polyunsaturated fatty acids (PUFA) enrichment in breast muscle of broiler chickens and the expression of lipogenic genes were investigated. Broiler chickens were fed ad libitum with diets containing 5% corn oil (CO), 3.75% corn oil + 1.25% linseed oil (CL1), 2.5% corn oil + 2.5% linseed oil (CL2), and 5% linseed oil (LO) based on the basic diets, respectively. Dietary 18:2n-6/18:3n-3 ratio did not affect 42-day body weight and 0–42-day feed conversion efficiency (feed/gain, $P > 0.05$) of broiler chickens, however, 5% linseed oil significantly increased 0–21-day feed conversion efficiency (feed/gain, $P < 0.05$) and decreased breast muscle weight (by 16%, $P < 0.05$) of broiler chickens. With the decrease of dietary 18:2n-6/18:3n-3 ratio, the enrichment of total n-3 PUFA, 18:3n-3, 20:5n-3, and 22:5n-3 increased linearly ($P < 0.01$), while the enrichment of total n-6 PUFA and 18:2n-6 decreased linearly ($P < 0.01$) in breast muscle of broiler chickens. Dietary corn oil increased the enrichment proportion of 20:4n-6 in a dosage-independent manner. Replacing 1.5% corn oil with linseed oil increased the enrichment proportion of 22:6n-3 ($P < 0.05$), but continuing to increase dietary linseed oil could not further elevate its deposition. Real-time quantitative RT-PCR was used to determine the expression of the mRNA levels of related genes. Dietary PUFA had insignificant effect on the expressions of LPIN2, WD and tetratricopeptide repeats 1 (WDTC1) and Δ -6 fatty acid desaturase (FADS2) in both breast muscle and abdominal fat. The effect of dietary PUFA on the expression of LPIN1 gene showed clear tissue dependence. Equivalent adding of corn oil and linseed oil could up-regulate the mRNA level of LPIN1 in abdominal fat ($P < 0.01$). This study demonstrated that decreasing dietary 18:2n-6/18:3n-3 ratio promoted the deposition of desirable n-3 long chain PUFA in the edible tissue and influenced the expression of LPIN1 in a tissue-dependent manner.

Keywords:

birds; performance; essential fatty acid; gene expression

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