Relationship between dietary PUFA level and apparent absorption of vitamin E in poultry

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Vitamin E is the major lipid-soluble antioxidant present in nature. Its main function is to protect polyunsaturated fatty acids (PUFA) from peroxidation caused by free radicals. Some old works with rats (Weber et al., 1966, Gallo-Torres et al., 1971) have suggested that dietary PUFA interfere with the intestinal absorption of vitamin E so they increase vitamin E requirements not only because they are easily oxidized and need more protection but also because lower vitamin E intestinal absorption. More recent papers question this fact (Tijburg et al. 1997). The objective of our work was to evaluate to what extent dietary PUFA have an effect in the apparent absorption of α-tocopherol in broiler chickens.

One hundred and ninety-six female broiler chickens (8 d) were randomly distributed into 16 experimental groups resulting from the combination of 4 levels of dietary PUFA (15, 34, 45 and 61 g/kg) and 4 levels of supplementation of Vitamin E as α-tocopheryl acetate (0, 100, 200 and 400 mg/kg). The unsaturation gradient was achieved by replacing linseed and fish oil to a basal diet enriched with 9% tallow. A digestibility balance was carried out between days 18 and 22 of age. Feed consumption and total faecal excretion were measured. Faecal samples were collected, lyophilised, milled and stored at -80° C for subsequent analysis. Feed samples were also milled and stored at -80° C.

α-tocopherol and α-tocopheryl acetate content in feed and faeces were determined by HPLC using a direct solvent extraction method described by Lee et al. (1999). 1-Phenyldodecane was used as an internal standard for quantification. Total fatty acid content in feed and faeces was determined by GC following transmethylation in methanol-HCl, as described by Sukhija and Palmquist (1988). C_{19} was used as the internal standard for quantification. The apparent absorption of α-tocopherol was calculated as intake minus excretion of α-tocopherol equivalents (1 mg of *all rac* α-Tocopheryl acetate = 0.67 mg of d-α-tocopherol) expressed as a percentage of the intake. The apparent absorption of total fatty acids was calculated in the same way.

Apparent absorption of α-tocopherol decreased as the level of inclusion of α-tocopheryl acetate in the diet increased (41.7%, 37.4% and 30.8 % for 100, 200 and 400 mg/kg respectively, $p \leq 0.05$). Dietary PUFA affected apparent absorption of both total fatty acids (47.4% for 15 g/kg vs. 65.9% for 34 g/kg and 74.4% and 78.5% for 45 and 61 g/kg, $p \leq 0.001$) and α-tocopherol (21.4% for 15 g/kg vs. 40.7%, 42.1% and 42.3% for 34, 45 and 61 g/kg, $p \leq 0.001$). The low absorption of saturated fat impairs the absorption of other lipidic substances, as it has happened with α- tocopherol in the tallow-rich diet. Besides this, we couldn't find any significant difference in α-tocopherol apparent absorption among the rest of unsaturated treatments, suggesting there is no interference of the dietary PUFA level in α-tocopherol uptake in our levels of inclusion. Nevertheless, a possible degradation of α-tocopherol while protecting PUFA in the gastrointestinal tract should be considered.

References:

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