The effect of different dietary levels of vitamin E and selenium on antioxidant status and immunological markers in serum of laying hens

Z. Zduńczyk¹, A. Drażbo², J. Jankowski², J. Juśkiewicz¹, A. Czech³, Z. Antoszkiewicz⁴

¹ Institute of Animal Reproduction and Food Research, Polish Academy of Sciences, Tuwima 10, 10-748 Olsztyn, Poland
² Department of Poultry Science, Faculty of Animal Bioengineering, University of Warmia and Mazury, Oczapowskiego 5, 10-718 Olsztyn, Poland
³ Department of Biochemistry and Toxicology, Faculty of Biology and Animal Breeding, University of Life Sciences, Akademicka 13, 20-950 Lublin, Poland
⁴ Department of Animal Nutrition and Food Management, Faculty of Animal Bioengineering, University of Warmia and Mazury, Oczapowskiego 5, 10-718 Olsztyn, Poland

Abstract

The effect of different dietary levels of selenium (Se) and vitamin E on egg production, the antioxidant status and the immune system response of hens was investigated in the current study. A total of 32 Lohman Brown hens were divided into four groups and were fed diets with 5% of soybean oil and two levels of Se (0.15 and 0.30 mg/kg) and vitamin E (30 and 60 mg/kg). During 10 weeks of experimental feeding, the body weights of hens and egg production were similar in all dietary treatments, but a higher Se content of diets contributed to a significant increase in egg weight. A higher vitamin E level significantly increased α-tocopherol concentrations (2.71 vs. 2.05 μg/mL, p = 0.001), superoxide dismutase (SOD) activity (43.3 vs. 39.9 U/mL, p = 0.049) and the ferric reducing ability of serum (FRAP) (123.0 vs. 105.7 μmol/L, p = 0.029). A higher Se content increased the concentrations of ascorbic acid (0.309 vs. 0.073 μg/L, p = 0.001), retinol (1.48 vs. 1.15 μg/mL, p = 0.001) and α-tocopherol (2.86 vs. 1.90 μg/mL, p = 0.001), the activity levels of catalase (3.40 vs. 2.98 U/L, p = 0.010) and SOD (43.4 vs. 30.8 U/mL, p = 0.040) as well as the total antioxidant status (TAS) of serum (0.38 vs. 0.28 mmol/L, p = 0.026). There were no significant differences in the concentrations of tumor necrosis factor-alpha (TNF-α) and interleukin-6 (IL-6) between treatments, while a higher vitamin E content of diets increased serum immunoglobulin A (IgA) concentrations (370.6 vs. 321.3 μg/mL, p = 0.026). Higher dietary levels of vitamin E and Se increased the serum concentrations of retinol (1.66 vs. 2.20 μg/mL, p = 0.013) and α-tocopherol (3.33 vs. 1.71, p = 0.014), but they had no effect on the other physiological parameters. It is recommended that the levels of both supplements, Se and vitamin E, be increased in laying hen diets as they have a beneficial effect on the serum concentrations of retinol and α-tocopherol.

Key words: laying hens, selenium, vitamin E, antioxidant status, IgA, IL-6, TNF-α.

Correspondence to: Z. Zdunczyk, e-mail: z.zdunczyk@pan.olsztyn.pl