

Effect of selenium sources on laying performance, egg quality characteristics, intestinal morphology, microbial population and digesta volatile fatty acids in laying hens

ABSTRACT

The use of toxic and less bioavailable inorganic selenium can now be supplemented with an alternative organic source from bacterial species in nutrition for human and animal benefit. This study investigated the effects of selenium sources on laying performance, egg quality characteristics, intestinal morphology, caecum microbial population, and digesta volatile fatty acids in laying hens. One hundred and forty-four Lohman Brown Classic laying hens, at 23 weeks of age, were divided into four experimental groups (36 hens in each), differing in form of Se supplementation: no Se supplementation (Con), 0.3 mg/kg of inorganic Se in the form of sodium selenite (Na_2SeO_3), 0.3 mg/kg of organic Se from selenium yeast (Se-Yeast), and 0.3 mg/kg of organic Se from *Stenotrophomonas maltophilia* (bacterial organic Se, ADS18). The results showed that different dietary Se sources significantly affected laying rate, average egg weight, daily egg mass, feed conversion ratio (FCR), and live bodyweight (LBW) ($p < 0.05$). However, average daily feed intake and shell-less and broken eggs were unaffected ($p > 0.05$) among the treatment groups. The findings revealed that selenium sources had no ($p > 0.05$) effect on egg quality (external and internal) parameters. However, eggshell breaking strength and Haugh unit were significantly ($p < 0.05$) improved with organic (ADS18 or Se-yeast) Se-fed hens compared to the control group. In addition, egg yolk and breast tissue Se concentrations were higher ($p < 0.05$) in the dietary Se supplemented group compared to the control. Intestinal histomorphology revealed that hens fed ADS18 or Se-Yeast groups had significantly ($p < 0.05$) higher villi height in the duodenum and jejunum compared to those fed Na_2SeO_3 or a basal diet. However, when compared to organic Se fed (ADS18 or Se-Yeast) hens, the ileum villus height was higher ($p < 0.05$) in the basal diet group; with the lowest in the SS among the treatment groups. A significant increase ($p < 0.05$) of *Lactobacilli* spp. and *Bifidobacteria* spp., and a decrease of *Escherichia coli* and *Salmonella* spp. population were observed in the organic (ADS18 or Se-yeast) compared to inorganic supplemented and control hens. The individual digesta volatile fatty acid (VFA) was significantly different, but with no total VFA differences. Thus, bacterial selenoprotein or Se-yeast improved the performance index, egg quality characteristics, egg yolk and tissue Se contents, and intestinal villus height in laying hens. Moreover, caecum beneficial microbes increased with a decrease in the harmful microbe population and affected individual cecal volatile fatty acids without affecting the total VFA of the laying hens digesta.

Keyword: Bacterial selenoproteins; Laying performance; Egg quality characteristics; Intestine histomorphology; Caecum microbes; Digesta volatile fatty acids; Laying hens