

any negative effect on performance indices. Vitamin E also had some minor effects on these same parameters, but it reduced the performance significantly ($P < 0.01$).

Key Words: *Echinacea*, levamisole, vitamin E, blood parameters, broiler

328P Humoral immunity modulation of broiler chicken by an ethanolic extract of propolis. S. N. Khaleghi Miran¹, M. A. Karimi Torshizi¹, M. R. Bassami*^{1,4}, and R. Toroghi³, ¹Tarbiat Modares University, Tehran, Iran, ²Ferdowsi University of Mashhad, Mashhad, Iran, ³Razi Vaccine & Serum Research Institute, Mashhad, Iran, ⁴The Research Institute of Biotechnology, Ferdowsi University of Mashhad, Mashhad, Iran.

This study was conducted to determine the effect of different levels of ethanolic extract of an Iranian propolis (EEP) on humoral immunity of broilers during 42 days of an experiment. Ethanolic propolis extracts were prepared according to a standard method. Day-old male broiler chickens were distributed to 4 dietary treatments in a completely randomized design. Each treatment had 4 replicate floor pens, with each replicate consisting of 10 chickens. The 4 experimental diets were prepared by adding EEP to the basal diet at levels of 0 (control), 150, 300, and 450 mg/kg. Vaccination against Newcastle disease (ND) and Avian influenza (H9N2) were performed on day 7 using eye drop (Live B1 strain) and subcutaneous injection (ND and H9N2 killed vaccines). As a booster, another live ND vaccine (Lasota strain) was performed via drinking water at day 23. Immune responses to the vaccines were assessed by measuring hemagglutination inhibition (HI) titers in serum samples on days 21 and 42. Data analyses by GLM procedure of the SAS including linear and quadratic contrasts of HI titer in all treatments showed that HI titers against ND linearly increased with increasing levels of EEP supplementation on days 21 and 42 ($P < 0.05$). The highest titer was obtained in birds fed diets containing EEP at 300 mg/kg of diet (4.60 and 5.50 HI units for 21 and 42 day of age, respectively). Beyond this level, HI titer declined (3.90 and 5.10 HI units for 21 and 42 day of age, respectively). The administration of EEP improved the AI titer compared to control (2.77 vs 2.30 and 2.00 vs 0.90 HI units for 21 and 42 day of age, respectively; $P > 0.05$). In conclusion, the linear relationship between EEP levels and HI titers for both ND and AI vaccines suggests that EEP may be a promising immunomodulator for broilers. EEP supplementation at the rate of 300 mg/kg appear optimum for immune modulation in broiler chickens.

Key Words: propolis, broiler, humoral immunity, ND, AI

329P Comparison of selenium source and vitamin E on broiler performance. A. R. Valipouri¹ and S. Rahimi*¹, ¹Tarbiat Modares University, Tehran, Iran, ²Tarbiat Modares University, Tehran, Iran.

To evaluate the effect of selenium sources with and without vitamin E on performance and intestinal morphology of broilers, a total of 600 one-day-old male broiler chicks (Arbor Acres Plus) were placed at random into 6 dietary treatments by 5 replicates of 22 birds per pen. Dietary treatments including: 1) basal diet (Ctl), 2) diet 1+0.3 ppm, organic selenium (Sel-plex[®]) (SY), 3) diet 1+0.3 ppm SY+50 mg vitamin E/kg (SY+E), 4) diet 1+0.3 ppm inorganic selenium (SS), 5) diet 1+0.3 ppm SS+50 mg/kg vit. E (SS+E) and 6) diet 1+50 mg/kg vit. E (E). All data were analyzed by ANOVA. Body weight gain were not affected by the treatments until 21 days of age ($P > 0.05$), but in second period

of rearing (21-42d) SY, SS, SS+E and E groups showed a higher BWG than Ctl ($P < 0.05$). Overall BW in SY and SS groups were significantly higher than Ctl. Two Se sources and SY+E had the best feed conversion ($P < 0.05$). Feed consumption was not significantly affected by dietary treatments. At the end of the experiment, 5 birds of each group were killed for evaluation of intestinal morphology. Villous height in duodenum in SY group and depth of crypts in jejunum in SS were higher than other groups ($P < 0.05$).

Key Words: selenium, vitamin E, intestinal morphology, broilers

330P Comparing the antioxidant activity of four marine algae, with vitamin E and a synthetic antioxidant, BHT. F. Armin¹, S. Rahimi*¹, M. A. Karimi Torshizi¹, and A. M. Abkenar², ¹Tarbiat Modares University, Tehran, Iran, ²Fisheries Research Center, Chabahar, Iran.

An experiment was conducted to compare the antioxidant activity of four marine algae, *Sargassum* sp., *Nizimuddinia* sp., *Hypnea* sp. and *Ulva* sp. with vitamin E and a synthetic antioxidant, BHT. The antioxidant activity was measured using the 2,2-Diphenyl-1-Picrylhydrazyl (DPPH) test. The results demonstrated that the highest antioxidant activity of marine algae was evidenced in *Sargassum* sp. and then *Nizimuddinia* sp., so that EC50 values were 60 and 72 mg/mL respectively. Two other marine algae had the lower antioxidant activity. Antioxidant activities of marine algae were low compared to common antioxidant such as vitamin E and BHT. The results of this experiment suggest that marine algae have antioxidant activity and could have application for increasing stability of poultry meat.

Key Words: algae, vitamin E, BHT, antioxidant

331P Biochemical and molecular characterization of folate-dependent enzymes in laying hens supplemented with dietary folic acid and 5-methyltetrahydrofolate. G. B. Tactacan*, M. Jing, S. Thiessen, J. C. Rodriguez-Lecompte, W. Guenter, and J. D. House, University of Manitoba, Winnipeg, MB, Canada.

Folic acid (FA) is the most commonly used supplemental dietary source of folate. FA is not a natural folate metabolite, and its conversion to the biologically active 5-methyltetrahydrofolate (5-MTHF) form is regulated by the activity of key enzymes in the folate cycle. In order to gain further insight on the factors regulating the conversion of FA to 5-MTHF, a study was conducted to examine the impact of dietary folate supply (FA vs. 5-MTHF) on mRNA expression and activity of key folate enzymes. A total of 24 laying hens (24 weeks) of each strain (Shaver White and Shaver Brown) were randomly assigned to receive 1 of 3 ($n=8$) dietary treatments: 1) basal diet with no supplemental folate and 2) basal diet + 10 mg/kg FA and 3) basal diet + 11.30 mg/kg 5-MTHF, for 21 days. The hepatic activity and mRNA abundance (as determined by real-time PCR) of folate-dependent enzymes were measured as response parameters. The level of hepatic activity of dihydrofolate reductase (DHFR), serine hydroxymethyltransferase (SHMT), methylenetetrahydrofolate reductase (MTHFR) and methionine synthase (MS) were influenced by the level and form of folate supplemented in the diet. Hepatic DHFR and SHMT activities were higher (17.9 vs. 15.6 mmol/hr/g) ($P < 0.05$) in FA-fed hens, while MS activity was lower (632.9 vs. 728.4 nmol/hr/g) ($P < 0.05$) in 5-MTHF-fed birds, as compared to hens receiving the control diet. Gene expression analysis of genes encoding the 4 folate-dependent enzymes tended to follow similar trends; however the results