Gene expression study reveals the association of dietary supplementation of Actigen and the regulation of pathogen-influenced signaling pathways in broiler chickens. R. Xiao1,2, R. F. Power1,2, D. Mallonee1,2, L. Spangler1, K. Routt1, K. M. Brennan1,2, J. L. Pierce1,2, and K. A. Dawson1,2, 1Alltech, Nicholasville, KY, 2Alltech–University of Kentucky Nutrition Research Alliance, Lexington.

Actigen, a commercial product derived from yeast cell wall mannann oligosaccharides, is added to poultry diets to promote intestinal health. Previous research suggested that the beneficial effects of Actigen are related to enhanced mucosal immunity. This study investigated the effects of dietary supplementation of Actigen on the gene expression profile of broilers, and gained insights on the mechanisms related to immunomodulatory activities. One-day old chicks were either fed a corn-soya based diet (Control) or a diet supplemented with 400g Actigen/ton for 42d. Jejunum samples were collected and used for gene expression analysis using an Affymetrix microarray system. Results indicated that 928 genes in the jejunum were significantly changed (P < 0.05, FC > 1.2) by Actigen. Gene ontology analysis indicated that a broad range of biological functions were associated with altered genes. More interestingly, pathway analysis suggests a strong connection between Actigen and upregulation of signaling pathways that are directly involved in cellular immune response, inflammatory response and antimicrobial response such as toll-like receptor signaling, interferon signaling and retinoic acid inducible protein-1 (RIG1) receptor mediated innate immunity. Significant upregulation of such genes as toll-like receptor 3 (TLR3), myxovirus resistance 1 (MX1), interferon regulatory factor 7 (IFN7), suppressor of cytokine signaling 1 (SOCS1) and downregulation of ADP-ribosyltransferase (CHAT2) further indicate that Actigen has modulatory effects on the intestinal immune system.

Key Words: Actigen, mannann-oligosaccharides, immunomodulation, gene expression, broiler chicks

Effect of medicinal plants on protein and lipid oxidation of broilers meat. A. Niknam, S. Rahimi*, S. Askari, M. Hoseinzade, and M. A. Karimi Torshizi, Department of Poultry Science, Faculty of Agriculture, Tarbiat Modares University, Tehran, Tehran, Iran.

Lipid and protein oxidation are major causes of deterioration in the quality of meat products. By increasing consumption of prepackaged raw meat, control of oxidation has become very important. Currently, ï· tocopheryl acetate is used as antioxidant to control oxidation in meat and its products. Other antioxidant agents such as medicinal plants also can be used to approach to this purpose. The aim of this study was to compare the effectiveness of antioxidants in prevention of lipid and protein oxidation of broiler meat. A total of 200 one-day-old male broiler chicks (Arbor Acres) randomly assigned to 4 treatments with 5 replicates in a completely randomized design. Treatments were as follows: basal diet as control; or supplemented with vitamin E (100IU/kg diet); garlic (Allium sativum) (15g/kg feed); or peppermint (Mentha piperita) (15g/kg feed). In d 42 of experiment, 15 birds per treatment were sacrificed by cervical dislocation and tissue samples were taken from the breast and thigh muscles. The samples were stored at −18°C for 7 d. Lipid and protein oxidation were determined by the TBARS and carbonyl contents of samples. The results showed that vitamin E significantly decreased both lipid and protein oxidation reactions in breast muscle rather than other treatments (P < 0.05). But, lower MDA level was observed for garlic treatment in compare with peppermint treatment (P > 0.05). Neither garlic nor peppermint could decrease lipid and protein oxidation in thigh muscle like vitamin E (P < 0.05).

However, a significant difference was found between garlic and control treatments (P < 0.05). Protein carbonyl content showed a similar trend to that observed for MDA values in all groups in both breast and thigh muscles. Results of this experiment demonstrated antioxidant properties of garlic as a natural antioxidant and its protective role against lipid and protein oxidation.

Key Words: lipid oxidation, protein oxidation, vitamin E, medicinal plants, broilers

Reducing cholesterol levels in broiler serum and meat using Ocimum basilicum. S. Askari, S. Rahimi*, A. Niknam, M. Hoseinzade, M. A. Karimi Torshizi, and F. Asadi, Department of Poultry Science, Faculty of Agriculture, Tarbiat Modares University, Tehran, Tehran, Iran.

Nowadays, public concern about negative effects of cholesterol on human health has been forced producers to use the various ways to reduce cholesterol level in poultry products. One of the solutions is application of antioxidant materials such as medicinal plants in poultry diets. This study was designed to evaluate the effectiveness of Ocimum basilicum in decreasing cholesterol levels in broilers serum and tissues. A total of 200 one-day-old male broiler chicks (Arbor Acres) randomly allotted to 4 dietary treatments with 5 replicates in a completely randomized design. The chicks were fed a basal diet (as control), or supplemented with vitamin E (110 IU/kg) or basil in 2 levels (15 and 30 g/kg). Basil plant was harvested, dried and ground. Blood samples were taken in d 42 of experiment from 3 birds per replicate. After sacrificing birds by cervical dislocation, tissue samples were collected from breast muscle. Serum cholesterol (Chol), TG, HDL and LDL levels were measured by photometric method and method Chol content was determined by enzymatic method. The highest concentrations of serum Chol, TG and LDL were observed for control diet (118.81, 52.83 and 76.05 mg/dL, respectively) and the lowest levels were found for vitamin E treatment (97.24, 36.65 and 45.92 mg/dL, respectively) (P < 0.05). No significant difference was observed for serum HDL content among groups (P > 0.05). The results of determination of Chol level in meat showed that the highest and lowest levels were related to control and vitamin E treatments, respectively (121.06 vs. 93.02 mg/dL) (P < 0.05). The obtained data for 1.5 and 3% basil treatments for all evaluated factors were not significantly different, but had significant differences with control and vitamin E groups (P < 0.05). Results of this experiment showed that basil can be used as an effective medicinal plant in decreasing levels of Chol in broilers serum and breast meat.

Key Words: cholesterol, serum, meat, Ocimum basilicum, broiler

Effects of turmeric rhizome powder and black pepper on blood constituents and performance of male broiler chickens. A. Akbarian, A. Golian*, H. Kermanshahi, A. Gilani, and S. Moradi, Ferdowsi University of Mashhad, Mashhad, Khorasan Razavi Province, Iran.

The objective of this study was to evaluate the effect of turmeric rhizome powder (TRP) and black pepper (BP) on blood constituents and performance of male broiler chickens. A total of 288 d-old male chicks

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of Ross 308 were used in a CRD experiment with a 2 × 3 factorial arrangement of 2 levels of TRP (0 and 0.05%) and 3 levels of BP (0, 0.05 and 0.1%) that were added to the starter and grower basal diets. Each diet was randomly fed to 4 replicates of 12 chicks each. Feed and water were provided ad-libitum throughout the experiment. Body weight gain (BWG), Feed intake (FI), and feed conversion ratio (FCR) were determined for each group of birds. Blood samples were collected from wing vein and were analyzed by an autoanalyzer at 21 d of age. The results showed that BWG, FI, and FCR of male broilers during different weeks were not influenced by TRP. Turmeric rhizome powder in the diets significantly (P < 0.05) decreased ALT (12 to 9 IU/L), but did not have an effect on AST and LDH activities and LDL, HDL, cholesterol and triglycerides concentrations of serum. Chloride and total electrolyte balance of serum were significantly decreased by TRP (P < 0.05), but sodium and potassium concentrations were not influenced by TRP. Black pepper at the level of 0.1% significantly reduced FCR in the first week, but this pronounce effect was not observed in the later weeks. Also, BP did not have a significant effect on BWG and FI. Serum metabolites of LDL, HDL, cholesterol, electrolytes and AST, ALT and LDH activities were not influenced by BP. Serum triglycerides were significantly (P < 0.05) reduced in birds fed diet contained 0.1% BP as compared with control diet (63.3 vs 87 mg/dl). There was not a significant interaction between TRP and BP on blood metabolites and performance of male broiler chickens.

**Key Words:** turmeric rhizome, black pepper, blood constituents, broiler chickens, performance

518 Evaluation of mistletoe (Viscum album) and water plantain (Alisma canaliculatum) on the growth performance, internal organ development, fatty acid composition and lipid oxidation of broiler. M. E. Hossain*,1, K. S. Kim1, G. M. Kim1, S. S. Sun2, J. D. Firman3, and C. J. Yang1, 1Department of Animal Science and Technology, Sunchon National University, Sunchon, Korea, 2Department of Animal Science, Chonnam National University, Gwanju, Korea, 3Department of Animal Sciences, University of Missouri, Columbia.

Mistletoe (Viscum album) and water plantain (Alisma canaliculatum) have been used as a food or drug in traditional medicine and recently in animal production. The present study was conducted to examine the potential use of water plantain and mistletoe as alternative feed additives for broiler. One hundred 40 Ross broiler chicks had been assigned to 4 dietary groups in 5 replications with 7 birds per replication for a period of 5 weeks following completely randomized design. The dietary groups were control (basal diet), antibiotic (basal diet + 0.05% oxytetracycline), mistletoe (basal diet + 0.5% mistletoe powder) and water plantain (basal diet + 0.5% water plantain powder). The results indicated that feed conversion ratio of the water plantain group was higher compared with the antibiotic group in the finishing period, but when considering the total period no differences were observed among the additive groups. Moisture content of both breast and thigh meat was higher, but crude fat and crude protein contents were lower in the water plantain group when compared with the other groups. The average thiobarbituric acid values of breast and thigh meat were not changed, but the water plantain group showed more susceptibility to oxidation at d 7 in breast meat. Among the fatty acids composition, linoleic acid was decreased and α-linolenic acid was increased, which resulted lower n6/n3 ratio of breast meat in the water plantain group whereas; supplemented groups showed higher PUFA content in thigh meat. Proventriculus and gizzard weight were increased in the water plantain group compare with the antibiotic and mistletoe group, but the other organs weight were not different among the treatment groups. Statistical difference was not found in the serum IgG concentration, but a numerical increased trend was observed in the supplemented groups. It is suggested from the study that low level of mistletoe and water plantain could be the natural feed additives for broiler.

**Key Words:** mistletoe, water plantain, performance, broiler

519 Effect of a mixture of cinnamaldehyde, carvacrol and capsicum oleoresin and of a combination of enzymes on performance of broilers fed standard and low dietary energy levels. C. Oguey* and D. M. Bravo, Pancosma, Geneva, Switzerland.

XTract 6930 (XT, Xtract 6930, Pancosma) is a blend of cinnamaldehyde, carvacrol and capsicum oleoresin. The increasing effect on ME of XT and non starch polysaccharides enzymes (EZ) has been demonstrated in previous studies. The objective of this trial was to evaluate the effect of XT and EZ alone or combined on performance of broilers fed standard or low energy levels. One day old male chicks were randomly allocated to one of the 6 following treatments (7 birds*10 cages/treatment): CT: corn and soybean meal control diet, with a standard energy level (d1 to 14: 2950 kcal/kg ME, d15 to 28: 3050 kcal/kg ME, d29 to 42: 3100 kcal/kg ME); XT: CT + 100 ppm XT; EZ: CT + 100 ppm EZ; XT50: CT + 100 ppm XT + 50 kcal/kg ME; EZ50: CT + 500 ppm EZ – 50 kcal/kg ME; and EZ_XT100: CT + 500 ppm EZ + 100 ppm XT – 100 kcal/kg ME. AMEn from d15 to 17 and FI, BWG and FCR per feeding period were measured and analyzed using the GLM procedure of SAS. Results showed that AMEn for EZ and XT were similar to CT (P > 0.36). Compared with CT, AMEn of EZ-50 and XT-50 tended to be reduced respectively by 25.1 kcal/kg (P = 0.25) and 41.3 kcal/kg (P = 0.08) and it was lower by 96.3 kcal/kg (P < 0.01) for EZ_XT100. From d14 to 28, FCR of XT50 and EZ-50 was similar to CT (respectively 1.57, 1.62 and 1.59 g/g, P = 0.16) and EZ_XT100 increased FCR compared with CT (+3.1%, P = 0.03). This suggests that performance in XT50 and EZ-50 groups is maintained compared with CT despite a reduced AMEn. However the association of EZ and XT combined to a 100 kcal/kg AMEn reduction is not sufficient to maintain FCR. For the whole trial duration, compared with CT, EZ and XT reduced (P < 0.05) FCR respectively by 1.7% and 2.7%, while CT, EZ-50, XT-50 and EZ_XT-100 had similar FCR (respectively 1.91, 1.90, 1.89 and 1.92 g/g, P > 0.13). This trial shows that XT-50 kcal/kg ME and EZ-50 kcal/kg ME, alone or combined can be applied to the diet of broilers without affecting the global performance of the birds.

**Key Words:** broiler, capsicum oleoresin, cinnamaldehyde, carvacrol, carbothydrate

520 Effect of a blend of carvacrol, cinnamaldehyde and capsicum oleoresin and of an antibiotic on growth performance, metabolizable energy and ileal digestibility. D. M. Bravo*,1, L. T. Albino2, and H. S. Rostagno, 1Pancosma, Geneva, Switzerland, 2Federal University of Viçosa, Viçosa, Brazil.

Our objective was to evaluate the effect of a mixture of carvacrol, cinnamaldehyde and capsicum oleoresin (XT, XTract 6930, Pancosma) on the performances (trial 1), ME and CP digestibility (trial 2) of broilers fed corn-sorghum-soybean meal diets with or without an antibiotic. In both trials, chicks were fed starter (S) until d21, grower (G) and finisher (F) until d40 and d45. The trials were complete randomized designs with 5 treatments (T). T1 was not supplemented. T2 contained 7 ppm avilamycine (AV) in S and 5 ppm in G/F. T3 contained 75 ppm
XT in S, G/F. T4 contained 150 ppm XT in S, G/F. T5 contained 3.5 ppm AV + 75 ppm XT in S and 2.5 ppm AV + 75 ppm XT in G/F. Nine rep. of 20 birds/T (trial 1) and 9 rep. of 10 birds/T (trial 2) were used. Birds and feed were weighted at d1, 21, 40, 45 (trial 1) and at d1, 7, 21 (trial 2). At d17–21, total excreta were collected to determine AMEn. At d22, chicks were killed and samples of terminal ileum were obtained for CP digestibility (CPD). The data were subjected to one-way ANOVA. Means were compared using the Duncan multiple range test. From d1 to 21, supplementation improved BWG (P < 0.160, +2.0% T3, +2.2% T4, +2.8% T5) but not G/F (P = 0.330). From d22 to 45, BWG was not altered (P = 0.380) but G/F was increased (P = 0.09, +1.3% T3, +1.9% T2, +2.7% T4). From d1 to 45, BWG was not affected (P = 0.150) and G/F was improved (P = 0.04) with highest effects for T4 (+2.3%) and T5 (+2.2%); no effect of T2 and T3. Highest CPD was observed with T5 (+5.5%), T4 (3.5%), T2 (+3.0%) and T3 (+2.8%), all being higher than T1 (P < 0.05). AMEn was not affected by T2, increased by T3 (+53 kcal, P > 0.05), T4 (+74 kcal, P < 0.05) and T5 (+114 kcal, P < 0.01). The results indicated that 150 ppm of XT improved G/F, CPD and AMEn. When compared with AV, XT showed similar performance, CPD and AMEn. Finally, when XT and AV were combined, G/F, CPD and AMEn were improved.

Key Words: capsicum oleoresin, carvacrol, cinnamaldehyde, broiler, ME

521 The effects of medicinal plants, nettle (Urticaceae dioica) chicory (Cichorium intybus) with enzyme on performance, and constituents in broilers. A. Safamehr*1,2, F. Fallah1, and A. Nobakht1, 1Department of Animal Science, Islamic Azad University, Maragheh branch, Maragheh, East Azarbyjan, Iran, 2Department of Plant & Animal Science, Nova Scotia Agriculture College, Truro, Nova Scotia, Canada.

This experiment was conducted to evaluate the effects of dietary inclusion of 2 herb medicinal, dried nettle (Urticaceae dioica) and chicory (Kemion) on performance, and biochemical and immunity parameters of broilers. This experiment was conducted in a completely randomized design with 250 male broiler chickens (Ross-308) in 5 treatments from 1 to 42 d. Birds were fed on 5 diets (a non supplemented corn-soybean meal diet (negative control); 2) the basal diet + E (%0.05, positive Control), 0.5% nettle + E (NE), 0.5% chicory + E (CE), and N+C plus E (NCE). Each diet was fed to 5 replicate pens of 10 male birds. Birds were given feed and water ad libitum. Dietary treatment had no effect on the feed intake, glucose, triglyceride, albumin and total protein. Dietary C or N herb with enzyme supplementation had the positive effect on body weight gain and feed conversion ratio (P < 0.05). Carcass and breast yield increased by inclusion of herbal (P < 0.05). The CE and NCE resulted in significantly lower cholesterol concentration compared with other dietary treatments (P < 0.05). Feeding the diets containing N or C or blend of them with enzyme significantly decreased the heterophile and proportion of heterophile to lymphocyte, whereas there was significant increase in lymphocyte percentage in experimental groups containing C or N (P < 0.05) compared with control diet. Thus, dried nettle and chicory may be used as a growth promoter for broiler chickens.

Key Words: nettle, chicory, enzyme, broiler

522 The effects of different levels of canola oil, lupin seed and garlic powder on performance, egg quality in laying hens. A. Safamehr*1,3, S. Farajollahzade1, M. H. Shahir2, and S. Chodaee1, 1Department of Animal Science, Islamic Azad University, Maragheh branch, Maragheh, East Azarbyjan, Iran, 2Department of Animal Science, Islamic Azad University, Maragheh, East Azarbyjan, Iran, 3Department of Plant & Animal Science, Nova Scotia Agriculture College, Nova Scotia, Canada.

One experiment was conducted to evaluate the effects of different levels of canola oil, Lupin seed and garlic powder on performance, egg quality of laying hens. A total of 288 Hy-Line W-36 Laying hens were fed diets with 2 levels of canola oil (1.5 and 3%), lupin seed (10 and 20%) and garlic powder (0.2 and 0.4) in a 2 × 2 factorial arrangement from 37 to 49 wk of age. All diets were formulated to be isonitrogenous and isonitrogenous. The results showed that inclusion different levels of canola oil, Lupin seed, and garlic powder to the diets had significant effect on performance (egg weight, egg production, egg mass, feed conversion ratio). Egg production and egg mass significantly decreased by high level of Lupin seed (P < 0.05). The highest egg weight (60.13 g) was observed in treatment containing 3% canola oil, 20% Lupin seed plus 0.4% garlic powder. The average egg production in treatment containing 3% canola oil plus 10% of Lupin seed and 0.4% of garlic powder was significantly higher than that of the control group (P < 0.05). There were no significant effects of different levels of canola oil, garlic powder and lupin seed and their interaction on egg quality (egg gravity, shell weight, Haugh unit, shell thickness) and yolk cholesterol. In conclusion, using of appropriate levels canola oil (1.5 percent), Lupin seed (20 percent) and garlic powder (0.4 percent) in laying hens diets can be improved performance and egg quality.

Key Words: garlic powder, lupin seed, canola oil, egg quality, layer hens

523 Impact of Oasis supplement and lysozyme on incidence of early mortality, digestive system development and growth performance of turkey poults having delayed access to feed and water. A. Gillcrist*, D. Anderson, and J. MacIsaac, Nova Scotia Agricultural College, Truro, Nova Scotia, Canada. Delayed intake of feed and water by turkey poults during long transport time to the growing facility may result in high early mortality rates and impact subsequent growth performance. This study evaluated the effect of providing supplements during the transport of poults, and during the early growing period. Eight hundred and 20 5 female poults were used in a 3 × 4 factorial analysis (transportation supplement x post placement supplement) with supplement provided during transport (no supplement (No), Oasis (O) and Oasis + lysozyme (OL)) and dietary supplement post-placement (no supplement (Ns), commercial antibiotic (A), lysozyme (L), commercial antibiotic + lysozyme(AL)) as the main effects. The (L) treatments were fed from 1 d through to 28 d of age whereas (A) was fed through to 70 d of age. Oasis during transport did not affect (P > 0.05) growth performance. Birds receiving (No) during transport and (L) post placement showed lower body weights at 70 d (P < 0.05) with a body weight of 4942g. All other treatment combinations showed body weights ranging from 5116 to 5526g. Feed consumption, feed conversion, and mortalities were not affected by dietary supplement (P > 0.05). Intestinal weights (duodenum (D), jejunum (J), ileum (I), proventriculus, gizzard) and lengths (D, I, and J) were not affected by dietary supplement (P > 0.05). Jejunum strength measured using a TA.TXplus texture analyzer at 28d showed significantly higher tensile strength (0.592kg force required to break) for birds that received (O) during transport and (Ns) upon placement (P < 0.05). Jejunum strength at 70d showed no differences among supplements (P > 0.05). Providing birds with dietary supplements during long transport did not improve mortality rates or subsequent growth.

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1152 d-old broiler chicks were used to investigate the influence of nutrient density and supplementation with essential oils or antibiotic growth promoters (AGP) on growth performance. Birds were assigned to 6 treatments with 8 replications per treatment: (1) Standard diet (SD), SD + Essential oils (oregano, anise, citrus) (Biomin P.E.P. 125 g/t), (2) SD + AGP (Enramycin, 10 g/t and salinomycin, 125 g/t), (3) Reduced diet (RD), (4) RD + Essential oils, (5) RD + AGP. Birds were fed starter (1–10 d), grower 1 (11–21 d), grower 2 (22–35 d) and finisher (36–42 d) diets. Diets in treatments 1–3 were formulated to meet the requirements of the birds for metabolizable energy protein and digestible amino acids, whereas diets in treatments 4–6 were formulated to provide 5% less energy and amino acids. From 1 to 42 d the birds fed diets with reduced nutrient and energy density had reduced (< 0.05) live weight and weight gain compared with the other treatments. Furthermore, birds fed diets with reduced nutrient and energy density showed an increase (< 0.05) in feed consumption, resulting in an increase (< 0.05) in feed conversion ratio. In conclusion, dietary supplementation with essential oils improved growth performance of birds from 1 to 21 d, hence may compensate for a reduction in dietary levels of amino acids and metabolizable energy.

Key Words: performance, fructooligosaccharides, broilers, essential oils


Actigen is a yeast cell wall derivative used as to enhance broiler intestinal morphology and performance, fructooligosaccharides, broilers, essential oils

and development of the birds through to market weight. Providing lysozyme to birds gave equal growth and intestinal development as birds that were receiving no supplement or an antibiotic supplement.

Key Words: turkey, mortality, oasis, growth, lysozyme
activities in broiler chickens. For this, 1-d-old chicks were randomly assigned to 5 levels of inclusion of Ethanolic extract of propolis: 0; 0.1; 0.2; 0.3; 0.4 and 0.5%, with 5 replications and 34 birds per experimental unit. Each treatment was supplemented from 1 to 21 d old, after that, all groups were fed with a basal diet. The activities of maltase and sucrase in the intestinal segments (duodenum, jejunum, ileum) and the lipase, amylase, trypsin and chymotrypsin activity in the pancreas were evaluated at 7, 21 and 42 d old. The data were analyzed by Anova followed by Dunnett’s test and also by linear and quadratic regression analysis. It was found a linear decrease in the body weight gain from 1 to 42 d old, with a lower gain with the increase of levels. A similar response was obtained to maltase activity in the duodenum at 7 d old ($P \leq 0.05$), in the jejunum at 21 d old ($P \leq 0.05$), in the ileum at 42 d old ($P \leq 0.05$). However, when the data were compared with the control group, the 0.5% supplemented group presented a higher sucrase activity in the jejunum at 21 d old ($P \leq 0.05$, Dunnett’s test). The feed conversion ratio and pancreatic enzymes activities in all ages were not affected by the levels of Ethanolic extract of propolis supplementation ($P \geq 0.05$). The results of this study suggest that Ethanolic extract of propolis supplementation affects the digestive process, decreasing the carbohydrate digestion by the disaccharidases in the small intestine. Moreover, this response causes the reduction in the chicken growth, endangering the performance.

Key Words: disaccharidase, enzymes activity, pancreatic enzymes, propolis


Dietary supplementation of Saccharomyces cerevisiae mannan oligosaccharide (MOS) is commonly used to manage the enteric microbial ecosystem of animals, including turkeys. MOS is thought to inhibit the colonization of pathogens and stimulate innate immunity and mucosal barrier function. Actigen (Alltech, Inc.), a concentrated mannose-rich oligosaccharide fraction derived from the cell wall of a specific strain of Saccharomyces cerevisiae, was evaluated for its effect on ileal villi morphology as an indicator of enteric health. 864 Hybrid Conventer turkey tom poults were randomly distributed among 48 floor pens and naturally challenged by placing them on used litter from a previous flock. Poults were fed one of 2 dietary treatments: a control diet (CON) or a diet containing 400 ppm Actigen (ACT). Both corn-soy-based diets were formulated to meet standard industry nutrient specifications and were supplemented with 66 ppm monensin. Feed and water were provided ad libitum to all birds throughout the study. Eight birds per treatment were sampled on 6, 10, and 14 d and ileal sections dissected for histomorphometric analysis and scanning electron microscopy (SEM) evaluation. At 10d, ACT increased villus surface area by 18% over CON (306 vs 257 μ², $P < 0.005$). At 14d, ACT reduced apical width 15% (78 vs 92 μ, $P < 0.02$), base width by 15% (173 vs 200 μ, $P < 0.02$), and crypt depth by 20% (183 vs 229 μ, $P < 0.005$), without effect on muscularis thickness or surface area. From SEM, segmented filamentous microorganisms were observed to be present on CON villi at 14 d but not on ACT villi. Moreover, there appeared to be more mucosal mucus secretion among ACT than CON. The results suggest ACT enhances ileal mucosa health of turkey poults.

Key Words: turkey, Actigen, yeast, villi, monensin

529 The effects of eucalyptus, rosemary and mint essential oils on cecal microflora and performance: A comparison to antibiotic effects in broilers. M. Koopaei1, K. Ghazvinian2, A. Mahdavi2, B. Darabi Ghane3, M. A. Jafari4, and F. Alemi3, 1Islamic Azad University-Ghaemshahr Branch, Ghaemshahr, Iran, 2Semnan University, Semnan, Iran, 3Islamic Azad University-Karaj Branch, Karaj, Iran, 4Iranian Research Organization for Science and Technology, Tehran, Iran.

The present study was carried out to determine the effects of eucalyptus, rosemary and mint essential oils on cecal microflora and performance. We also compared these results to the effects of antibiotic. The Cobb broilers studied here were distributed in 5 groups: the control group (basal diet), 3 groups fed with basal diet plus 0.02% essential oils (eucalyptus, rosemary and mint) and finally a group treated with basal diet mixed with 0.05% zinc bacitracin. On the d 49, the smallest E. coli count was that of the antibiotic group ($P < 0.05$) and among the essential oil groups, the mint group had the lowest E. coli count. The largest lactobacillus count was observed in the essential oil groups among which the rosemary group had the largest lactobacillus count. In the starter period (0–21 d), no significant difference in feed intake was observed among the groups; however, in the finisher period (36–49 d), the antibiotic group showed the highest feed intake ($P < 0.05$). In the starter period (0–21 d), the groups had no significant difference in body weight gain. But during the grower period (22–35 d) and the finisher period (36–49 d) the largest body weight gain was found in the antibiotic group and the rosemary group, respectively, although no significant difference was observed between the essential oil groups and the antibiotic group. Feed conversion ratio in the groups treated with essential oils was significantly reduced compared with this ratio in the control group; the rosemary group had the lowest feed conversion ratio; and during the grower (22–35 d) and the finisher periods (36–49 d) this group showed no significant difference from the antibiotic group regarding feed conversion ratio. It can be concluded that essential oils studied here were effective in enhancing performance by improving the cecal microflora compared with the control group, and among these groups, the group treated with rosemary essential oil achieved a better performance in comparison to the antibiotic group as a result of improved microflora.

Key Words: essential oil, microflora, performance, antibiotic


The purpose was to evaluate the effect of diets containing different levels of spray dry sugar cane yeast on the morphometric development of the intestinal mucosa of laying hens in the laying phase. 200 birds were used, 47 weeks of age, strain Lohman, distributed in a completely randomized design consisting of 5 treatments and 5 replicates of 8 birds each. The treatments consisted of increasing levels of 0, 2, 4, 6 and 8% inclusion of spray dry sugar cane yeast. The experiment lasted 84 d, 3 cycles of 28 d. At the end of the experiment, 1 bird with an average weight of the parcel was sacrificed by cervical dislocation for collection of approximately 2 cm from the mean portion of each segment of small intestine (duodenum, jejunum and ileum). Subsequently 2 slides were prepared for each segment of each animal to
evaluate the parameters of villus height, crypt depth and villus: crypt ratio. The data obtained for all variables were tested for their homogeneity, with the aid of the Bartle’s Test; when necessary, the data suffered log-transformation of (x). Finally, all data were submitted to the regression analysis. The heights of the villi of the duodenum showed no significant differences (1,317.5 μm), however, there was a quadratic effect on crypt depth in this same segment, with lower crypt depth in the 5.46% level of inclusion of yeast. The villus: crypt ratio in the duodenum behaved in a linear way (Y = 0.716084 + 0.021508X). The reduction in crypt depth may indicate a reduction in cell synthesis due to less wearing of the villi of the duodenum. In the jejunum and ileum adding yeast to the diets did not provide significant effect on the parameters. The averages were: 866.6 and 557.0 μm for villous height, 171.5 and 118.3 μm for crypt depth and, 5.35 and 5.00 μm for segments of the jejunum and ileum, respectively. It’s possible to verify that the spray dry sugar cane yeast may be included in the diet of hens in laying stage to the level of 5.46% to reduce the energy requirement for cell synthesis without compromising the integrity of the villi in all segments of the small intestine.

Key Words: laying hens, sugar cane yeast, intestinal morphology

531 Hematology, organ development and performance of broiler finishers fed rations supplemented with Telfaria occidentalis leaf meal (TOLM) (Ugo leaves). A. H. Ekeocha*, University of Ibadan, Ibadan, Oyo, Nigeria.

One hundred and 50 d old Arbor Acre broiler chicks were randomly allocated to 5 experimental rations of 30 birds each. The first ration was standard (basal) finisher ration and served as control. The other rations contained 2.5%, 5.0%, 7.5% and 10.0% TOLM respectively as graded replacement (w/w) for wheat bran. The study investigated the performance, organ development and hematological responses of the birds to the diets. Telfaria occidentalis leaf meal supplementation improved performance characteristics over basal diets and significantly (P < 0.05) enhanced feed intake, growth rate, hematological parameters (erythrocyte count and Hemoglobin concentration) while organ weights were largely unaffected except for an increase in liver and heart weights of Telfaria occidentalis leaf meal fed broilers. The Telfaria occidentalis leaf meal at 7.5% level of inclusion was found to conveniently replace wheat bran without any deleterious effect on the growth response and organ weights of broilers at the finisher phase.

Key Words: hematology, organ development, broiler finishers, Telfaria occidentalis leaf meal

532 Response of broiler starters fed rations supplemented with Vernonia amygdalina leaf meal (VALM) (Bitter leaf). A. H. Ekeocha*, University of Ibadan, Ibadan, Oyo, Nigeria.

One hundred and 50 d old Arbor Acre broiler chicks were randomly allotted to 5 experimental rations of 30 birds per treatment such that each treatment had 3 replicates of 10 birds. The first ration was the standard (basal) starter ration and served as control. The other rations contained 2.5%, 5.0%, 7.5% and 10.0% VALM respectively as graded replacement (w/w) for wheat bran. The study investigated the performance of the birds to the diets. Vernonia amygdalina leaf meal supplementation did not improve performance characteristics over basal diets but significantly (P < 0.05) decreased feed intake, feed conversion ratio and growth rate. The average final body weight decreased as the levels of VALM increased in the diets with highest value of 561.83g. There were no significant (P > 0.05) difference in the average daily weight gain between broilers fed the control 0% (VALM) and 2.5% (VALM) diets which were significantly (P < 0.05) higher than the observed values recorded in other diets. The highest value of average daily feed intake was recorded for broilers fed 0% VALM diet. The feed conversion ratio significantly increased as the levels of VALM inclusion increased in the diets. The blood glucose level significantly (P < 0.05) reduced as the levels of VALM inclusion increased in the diets. Values obtained for serum chemistry (serum albumin, globulin, total serum protein and serum uric acid) were not significantly (P > 0.05) different. The Vernonia amygdalina leaf meal at 2.5% level of inclusion was found to conveniently replace wheat bran without any deleterious effect on the growth response of broilers at the starter phase.

Key Words: broiler starters, Vernonia amygdalina leaf meal

533 Dose responses to a dietary experimental MOS product versus a leading commercial MOS product in a 42-day broiler chicken pen trial with relatively high stocking density and recycled litter. T. T. Lohrmann* and M. D. Sims, Quality Technology International (QTI), Elgin, IL, Virginia Diversified Research Corp., Harrisonburg.

A 42-d pen trial was conducted with 1,500 straight-run Cobb 508 broiler chicks using 5 dietary treatments: 1) negative control (NC); 2) 0.1% commercial mannan oligosaccharide (MOS) product (comMOS); 3) 0.025% new, experimental MOS product (expMOS); 4) 0.05% expMOS; 5) 0.1% exp MOS. The comMOS prod analyzed 29.3% mannan and 65.0% glucan and the experimental MOS had 53.5% mannan and 46.3% glucan (% of total carbohydrate weight). There were 10 replicate pens of 30 chicks each per treatment (50 pens total). Each pen measured 1.22 × 1.52 m, which provided a stocking density a stocking density of 0.062m² or 0.67 ft² per bird. Chicks were placed on 7.6 cm of clean litter initially, and at 7 d of age 0.91 kg of recycled litter was added to each pen. Salinomycin 60 g/ton was added to all starter and grower feeds (0–35 d). At 21 d, BW was significantly (P = 0.009) increased by 0.1% expMOS vs NC, and each expMOS or comMOS treatment significantly (P < 0.001) improved feed conversion ratio (FCR) compared with NC. At 35 d, BW was significantly (P < 0.001) greater for 0.05 or 0.1% expMOS or 0.1% MOS-fed birds than for NC birds, and mortality-adjusted FCR was significantly (P < 0.001) improved by each expMOS or comMOS treatment vs NC. Mortality % from 0 to 21, 0–35 or 0–42 d was unaffected by treatment. Fecal microbial profiles (enterobacteria, lactobacilli and total anaerobes) at 27–28 d were unaffected by treatment. In conclusion, 0.025% expMOS gave 42-d BW equivalent to that of 0.1% comMOS while 0.05% and 0.1% expMOS increased 42-d BW vs other treatments. Each MOS treatment improved 0–42 d mortality-adjusted FCR (expMOS most effective) vs NC.

Key Words: MOS, mannan oligosaccharide, broiler, FCR, calorie conversion


The study was conducted to evaluate the effect of diets supplemented with C. frutescens on chicken laying performance and egg quality. Specifically, it aimed to determine the biological performance, production efficiency and egg quality. Three hundred 20 heads of 54–70 weeks old Lomann layers were used in 4 (4) months feeding trial. They were randomly distributed in 4 dietary treatments following the single
factor experiment. Each treatment is replicated 8 times with 16 heads for each replicate. Experimental diets were formulated to contain 17.7 percent crude protein and ME level of 2650 kcal/kg following the nutrient recommendation by (Philsan, 2003). The experimental additive was incorporated in the ration following the inclusion rates of 0.5, 1.0, 1.5 and 2.0 percent. Layers were fed with treated and pre-weighed diets 4 d a week. Feed left was measured on weekly basis to determine the actual feed intake of layers. Application of effective micro-organisms (EM) on manure was done to regulate ammonia build-up and rapid flies multiplication. Results showed that feed consumption and feed efficiency of layers were significantly ($P < 0.05$) affected by addition of $C. frutescens$ on the ration. However, hens egg production and monthly laying percentage from 54 to 70 weeks of age were comparable to those of control group ($P > 0.05$). Moreover, feed cost per kilogram of egg produced and income over feed cost were significantly affected ($P < 0.05$) by treated diets. Egg quality on the other hand were determined based on egg weight, yolk color intensity and shell thickness did not affect ($P > 0.05$) by treated diets. Among the parameters used in egg sensory evaluation, the general acceptability was found to be significant while comparable results were obtained from egg flavor, off-flavor and texture. Meanwhile, mortality rate was not significant indicating that $C. frutescens$ can improve overall health conditions of layers.

Key Words: $C. frutescens$, performance enhancer, egg quality, health performance, herbal

535 Comparison of herbal extracts, antibiotic, probiotic and organic acid on serum lipids, immune response, GIT microbial population, intestinal morphology and broilers performance. S. Rahimi,$^1$ S. Yakhkeshi*$^1$, K. Gharib Naseri$^1$, and A. Rahimi$^2$. $^1$Tarbiat Modares University, Tehran, Tehran, Iran, $^2$Islamic Azad University, Tehran, Tehran, Iran.

A study was conducted to investigate the effects of herbal extracts, probiotic, organic acid and antibiotic on serum lipids, immune response, intestinal morphology, GIT microbial population and performance of broilers. A total of 300 d-old male broilers (Cobb 500) were randomly divided into 4 treatments, 3 replicates with 15 birds in each. Treatments included: control, herbal extracts (Sangrovit), probiotic (Primalac), organic acid (Termin-8) and antibiotic (Virginiamycin). The greatest WG were achieved by Virginiamycin ($P < 0.05$) during the experiment. The highest and lowest FCR were obtained by control and Virginiamycin at 29–42 and 1–42 d of age, respectively ($P < 0.05$). Highest and lowest antibody titers against SRBC were observed in Primalac and Virginiamycin treatments, respectively ($P < 0.05$). The serum Chol, TG, LDL and HDL levels were affected by treatments ($P < 0.05$). Lowest mentioned parameters were obtained by Primalac and Sangrovit ($P < 0.05$). The lowest and highest coliform counts in ileum at 21 d of age were achieved in Virginiamycin and control, respectively ($P < 0.05$). Moreover, the highest and lowest lactic acid bacteria in crop, ileum and cecum at 21 d of age were respectively observed in Primalac and Virginiamycin, ($P < 0.05$). The lowest coliforms counts in ileum and cecum were attained by Virginiamycin at 42 d of age ($P < 0.05$). The highest and lowest villous height in duodenum and jejunum were attained by Primalac and control at 21 and 42 d of age, respectively ($P < 0.05$). Also greatest villi height: crypt depth in duodenum and jejunum were obtained by Primalac ($P < 0.05$). The results of current study have shown that administration of Primalac, Termin-8 and Sangrovit can improve broilers performance.

Key Words: Virginiamycin, Primalac, Termin-8, Sangrovit, broiler

536 Effects of yarrow (Achillea millefolium), antibiotic and probiotic on GIT microbial population, immune response, serum lipids and broilers performance. S. Yakhkeshi$^1$, S. Rahimi*$^1$, H. R. Hemati Matin$^1$, and A. Rahimi$^2$. $^1$Tarbiat Modares University, Tehran, Tehran, Iran, $^2$Islamic Azad University, Tehran, Tehran, Iran.

The study was conducted to investigate the effects of medicinal plant of yarrow (Achillea millefolium), probiotic (Primalac) and Virginiamycin on GIT characteristics and microbial population, serum lipids, immune response, and performance of broilers. A total of 250 one-day-old male broilers (Ross 308) were randomly allocated to 5 treatments, 5 replicates with 10 birds in each in CRD. Treatments were control, Virginiamycin (15 ppm), Primalac (0.1%), and 2 levels of yarrow powder (1.5 and 3%). Highest and lowest FCR were observed in control and Virginiamycin at d 42 ($P < 0.05$). Moreover, highest and lowest BWG were obtained by Virginiamycin and control, respectively ($P < 0.05$). Carcass yields were not different between treatments ($P > 0.05$). Relative weights of breast and thigh were similar between all treatments ($P > 0.05$). Relative weights of bursa Fabricius, spleen and primary immune response (total titer, IgY and IgM) against SRBC were not affected by treatments ($P > 0.05$). The serum Chol, TG, LDL and HDL levels were differently affected by treatments ($P < 0.05$). Lowest mentioned parameters were obtained by 3% of yarrow ($P < 0.05$). Highest and lowest antibody titers against SRBC were observed in yarrow (3%) and antibiotic treatments, respectively ($P < 0.05$). Highest lactic acid bacteria were attained by Primalac in crop, ileum and cecum ($P < 0.05$). Inclusion of Virginiamycin and yarrow (3%) caused a significant decrease in coliforms and total aerobic bacteria counts in crop, ileum and cecum ($P < 0.05$). The results of current study have shown that administration of yarrow (3%) can reduce the levels of serum lipids and GIT pathogenic bacteria, also improve broilers immune response. It is proposed that yarrow can be used as an antibiotic alternative in poultry diets.

Key Words: yarrow, Virginiamycin, Primalac, immune response, broiler performance


Pasture flock raised chicken is becoming an increasingly popular product. For these producers, prebiotics are a popular option because they are generally recognized as safe (GRAS) and can be mixed into the feed and thus do not require adjustments to production protocols. However, if prebiotic treatments reduce production performance, they would not be useful to producers. Thus, the objective of this study was to measure performance of pasture raised broilers fed one of 3 prebiotic treatments. For these trials, 2 breeds of birds were utilized, naked neck slow growers and Cornish and White Rock cross fast growers. The experimental design was replicated for each breed. A total of 340 birds were split into 4 groups, each group fed one feed additive 1) galactooligosaccharides (2Kg / ton); 2) fructooligosaccharides (1Kg / ton); 3) plum fibers (1Kg / ton); or 4) no additives. Every 2 weeks over the 8 week rearing period, 10 birds from each group were collected for small intestine samples. Histological preparations were made from the small intestine tissue and 4 measurements of villi height and crypt depth from each cross section were taken. Throughout the study mortality was monitored, mass measurements were taken at 2 week intervals and feed consumption measured daily. The group receiving feed
supplemented with plum fibers had the lowest final weight, poorest adjusted feed conversion and highest mortality. The group receiving the feed supplemented with GOS had the highest final weight, optimum adjusted feed conversion and lowest mortality. However, among all the groups none of these differences were statistically significant. Similarly, there were apparent differences in crypt depth and villi height but none of the differences were statistically significant. Finally, there were no differences in measurements by breed. The results of this study indicate that there were some apparent differences in performance measurements dependent on the prebiotic given, but the differences were not statistically significant. Therefore, the 3 prebiotics utilized in this study could be used without risk of decreasing production performance.

**Key Words:** prebiotic, feed, broiler, pasture flock, supplement

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### 538 Effect of Maxigen (yeast product) supplementation on broiler growth performance. Y. Fasina* and Y. Olowo, Auburn University, Auburn, Alabama.

Yeast products contain nucleotides that are essential for cellular functions and growth. Supplementing yeast products into broiler diets may enhance growth performance and overall flock uniformity. Accordingly, a 42-d experiment was conducted to evaluate the efficacy of Maxigen (a novel yeast product obtained from Canadian Biosystems, Canada) in enhancing broiler growth performance and flock uniformity. Four hundred and 80 d-old chicks were obtained from a commercial hatchery, weighed, and randomly assigned to 2 dietary treatments. Treatment 1 (CX, control) consisted of chicks fed corn-soybean meal (SBM) diet that was not supplemented with Maxigen. Treatment 2 (MG) consisted of chicks fed corn-SBM basal into which Maxigen was added at 0.075% level. Each treatment consisted of 12 replicate pens, with each pen housing 20 chicks. On d 21 and 42 of experiment, growth performance (body weight and feed conversion) and flock uniformity were assessed. Results showed that on d 21, there was no difference (P > 0.05) between the body weights, feed conversion efficiency, and flock uniformity of CX and MG chicks. However, by d 42, the feed conversion efficiency of MG chicks (1.67) became superior (P < 0.05) to that of CX chicks (1.71). In addition, flock uniformity of MG chicks (66.4%) was better than the uniformity of CX flock (56.8%; P = 0.0527). It was concluded that Maxigen supplemented at 0.075% level of the diet enhanced growth performance and flock uniformity of broiler chickens.

**Key Words:** Maxigen, yeast extract, flock uniformity, broiler chicks

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EconomasE (Alltech, Inc.) is a proprietary blend of ingredients that has been shown to improve the antioxidant status of poultry. A study was conducted to compare the effects of including EconomasE, vitamin E, and selenium (Se) in the diet of laying hens on production performance, egg quality and egg Se concentrations. Dietary treatments consisted of feeding 1) corn-soybean meal control diets (starter, grower and layer) without supplemental Se or vitamin E 2) control + 0.3 mg/kg Se as Na2SeO3, 3) control + 0.3 mg/kg Se as Na2SeO3 + 30 IU/kg of vitamin E, and 4) control + 0.2 g/kg EconomasE. Six replicate groups of 16 Hy-Line W-36 pullets were randomly assigned to each dietary treatment. Day-old birds were initially housed in pullet cages. At 17 wk they were moved to layer cages and the number of birds was reduced to 12 per replicate. The dietary treatments continued throughout the production period. Egg samples (6 per replicate) were taken every 4 weeks to evaluate egg quality. No significant differences were found among production performance and egg quality parameters. Overall average values for some of these parameters during Weeks 18 through 45 were: hen-day egg production = 83%, feed per hen per day = 96 g, feed/dozen eggs = 1.61 kg, egg weight = 57 g, per cent shell = 9.3, and shell breaking strength = 3.6 kg force. The concentration of Se in the egg contents (fresh basis) was significantly (P < 0.05) increased by the 3 supplemental treatments, compared with the control treatment (0.14 μg/g). Egg Se concentration for hens fed EconomasE was 0.32 μg/g, which was significantly higher than the respective values for the hens fed Na2SeO3 alone (0.22 μg/g) or with vitamin E (0.23 μg/g). The results indicate that adding EconomasE to laying hen diets increases egg Se levels, compared with supplements of Na2SeO3 alone or with vitamin E.

**Key Words:** EconomasE, selenium, vitamin E, egg quality, laying hen

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EconomasE (Alltech, Inc.) is a proprietary blend of ingredients that has been shown to increase the antioxidant status of poultry. The effect of supplementing diets with EconomasE or selenium (Se) alone or with vitamin E on production performance, egg quality and egg selenium concentration was studied using brown eggshell laying hens. Dietary treatments consisted of feeding 1) corn-soybean meal control diets (starter, grower and layer) without supplemental Se or vitamin E 2) control + 0.3 mg/kg Se as Na2SeO3, 3) control + 0.3 mg/kg Se as Na2SeO3 + 30 IU/kg of vitamin E, and 4) control + 0.2 g/kg EconomasE. Six replicate groups of 16 Hy-Line W-36 pullets were randomly assigned to each treatment. Day-old birds were housed in pullet cages. At 17 wk they were moved to layer cages and the number of birds was reduced to 12 per replicate. The dietary treatments continued throughout the production period. Egg samples (6 per replicate) were taken every 4 weeks to evaluate egg quality. No significant differences were found among production performance and egg quality variables. Overall average values for some of these parameters during Weeks 17 through 44 were: hen-day egg production = 85%, feed/hen/day = 108 g, feed/dozen eggs = 1.66 kg, egg weight = 61 g, per cent shell = 8.7, and shell breaking strength = 3.4 kg force. The concentration of Se in the egg contents (fresh basis) was significantly (P < 0.05) increased by the 3 supplemental treatments, compared with the control treatment (0.14 μg/g). Egg Se concentration for hens fed EconomasE was 0.33 μg/g, which was significantly higher than the respective values for the hens fed Na2SeO3 alone (0.24 μg/g) or with vitamin E (0.24 μg/g). The results indicate that increased levels of Se in eggs can be obtained with EconomasE supplementation of layer diets, compared with supplements of Na2SeO3 alone or with vitamin E.

**Key Words:** EconomasE, selenium, vitamin E, egg quality, laying hen
Impact of non-antibiotic alternatives on performance, gut inflammation and integrity in broiler chickens. H. Lu*, O. Adeola, and K. M. Ajuwon, Purdue University, West Lafayette, IN.

The study was conducted to determine the growth performance and inflammatory gene expression of 6 treatments on broilers chickens: organic acid (Orego-Stim), yeast extract (Alphamune), direct fed microbial (Avicorr), crude yeast extract, salinomycin (positive control, PC) and a non-treated group (negative control, NC). 672 d-old broilers were allocated to the 6 treatments. Each treatment had a total of 8 replicates at 14 birds per replicate. Birds were orally vaccinated with eimeria species using the coccivac B vaccine at 2 weeks (d 14) and at 5 weeks (d 35). On d 21 and 42, one bird per replicate was killed for expression analyses of mucin (MUC2), interleukin 1 (IL-1β) and 10 (IL10) and tumor necrosis factor (TNF-α) by RT-PCR in mucosal samples from the duodenum, jejunum, ileum and ceca tonsils. There was no significant difference in average daily gain (ADG) between treatments on d 21. However, on d 42 the ADG of birds treated with salinomycin was significantly higher than the Avicorr and Orego-stim treated groups ($P < 0.05$). Additionally, feed efficiency was improved by salinomycin compared with NC and Orego-stim treatments ($P < 0.05$). Gene expression levels were not different among treatments on d 21. However on d 42, expression level of TNF-α was lower in the Orego-stim treatment group than NC ($P = 0.0112$). In addition, birds treated with crude yeast had a significantly higher level of IL-10 ($P = 0.0229$). Overall, these results confirm the expected improved animal performance with antibiotic (salinomycin) treatment and further show reduced inflammation with organic acid (Orego-stim) treatment in broiler chickens.

Key Words: broiler chicken, challenge, inflammation, antibiotic alternatives