
An 84-d feeding trial was conducted to evaluate the utilization of Mexican sunflower leaf (MSL; Tithonia diversifolia) as dietary fiber source and economic of gain in guinea fowl diets. Five straight diets were formulated to contain the MSL at dietary levels of 0, 1.5, 3.0, 4.5, and 6.0% as a replacement for wheat bran. Ninety-day-old keets were randomly allotted to the 5 diets containing 3 replicates per treatment with 6 keets per replicate in a completely randomized design (CRD). Feed and water were provided ad-libitum and routine medications and vaccinations administered. Data were analyzed using descriptive statistics and ANOVA. The study investigated the performance and economic of gain. The results show a significant (P < 0.05) decrease in all the parameters measured for performance characteristics. The final body weight, daily weight, daily feed intake, and daily protein intake were generally higher in the birds fed control diet (0% MSL). There were significant (P < 0.05) differences in daily feed intake and daily protein intake between the control diet and the other groups, while daily weight gain, feed conversion ratio and protein efficiency ratio were statistically the same (P > 0.05) across board except at 6% level where there was a fall in weight gain. Digestible crude fiber values significantly (P < 0.05) decreased with increasing levels of MSL in the diets while the other digestibility percentages were comparable (P > 0.05) in all dietary treatments. Cost per kg feed decreased as the level of MSL inclusion in the diets increased while the cost per kg weight gain showed that birds fed on diet C (3.0% MSL) were the most economical to produce. The results suggest that Mexican sunflower leaf (MSL) could replace wheat bran in guinea fowl diet up to 6.0% as a dietary fiber source before envisaging deleterious effect.

Key Words: Mexican sunflower leaf, average production cost, guinea fowl

In-feed supplementation with 3 Bacillus spp. probiotic strains alleviates the effects of a necrotic enteritis challenge in broilers. Alexandra L. Wealleans* and Ceinwen E. Evans, Danisco Animal Nutrition, DuPont Industrial Biosciences, Marlborough, UK.

Two studies evaluated the effect of a combination of 3 Bacillus spp. probiotic strains (EP) on the growth performance of broiler chicks under a necrotic enteritis (NE) challenge. Three dietary treatments were tested, including an unchallenged control (UC) based on unmedicated corn-SBM-DDGS, a challenged control (CC), and CC supplemented with EP at 150,000 cfu/kg feed. Experiment 1 used 1050 male broiler chicks with 7 replicates per treatment; 50 birds/replicate. Experiment 2 used 1152 male broiler chicks with 8 replicates/treatment; 48 birds/replicate. Both experiments used built up litter and birds were artificially challenged with Necrotic Enteritis by dosing with a broth culture of Clostridium perfringens after a commercial coccidiosis vaccine challenge before placement in treatment pens. A field isolate of C. perfringens known to cause NE and originating from a SE commercial broiler operation was utilized as the challenge organism. Means separation was achieved using Tukey’s Honest Standard Difference test in the Fit Model platform of JMP 11; trial was included as a random effect. CC negatively impacted birds’ performance compared with UC, reducing weight gain by 40g/bird (d0–21), 73g/bird (d21–42) and 113g/bird overall. FCR was increased by 0.19 (d0–21), 0.12 (d21–42) and 0.14 overall. Addition of EP returned bird performance to the level of the unchallenged control (ADG 0–21d: 549.99g UC, 536.98g CC+EP, P > 0.05; 0–42d: 2092.86g UC, 2096.69g CC+EP, P > 0.05), as well as reducing mortality (6.11% CC, 2.43% CC+EP) and lesion scores (0.45 CC, 0.12 CC+EP) compared with the CC diet. At 42 d, the addition of EP reduced mortality-corrected FCR by 16 points compared with CC. This is equivalent to a saving of $130,000 per million birds and confirms the ability of these Bacillus strains to alleviate the effects of an NE challenge in unmedicated broiler diets.

Key Words: Bacillus, broiler, necrotic enteritis, performance, probiotic

Effects of supplementation with a β-glucanase/xylanase enzyme mix and a commercial blend of functional oils on broiler chickens fed wheat-barley based diets. Joan Torrent*1 and Enric Esteve-Garcia2, 1Oligo Basics USA LLC, Cary, NC. 2Institut de Recerca i Tecnologia Agroalimentàries (IRTA), Reus, Spain.

A performance and a metabolizability study were conducted to determine the effects of the supplementation of a commercial blend of functional oils, containing cashew nut shell liquid and castor oil as active ingredients (Essential, Oligo Basics Agroind. Ltda., Cascavel, Brazil), on broiler chickens fed wheat/barley diets with and without enzyme supplementation. Treatments were (1) no supplementation; (2) 0.0125% of a β-glucanase+xylanase enzyme preparation (Endofeed DC; Andreu Pintaluba, S.A. Reus, Spain); (3) 0.15% Essential; (4) 0.0125% of the enzyme preparation + 0.015% Essential. The feeding programs consisted of a starter (1–21 d; 2950 kcal ME/kg and 22% CP) and a grower diet (22–35 d; 3050 kcal ME/kg and 19% CP). In the performance study, 600 one-day male broiler chicks were randomly distributed in 24 pens and assigned to one of the 4 diets. In the metabolizability study, 192 d-old male broiler chickens were randomly allocated into 96 battery cages and fed one of the 4 treatments. Results from both experiments were analyzed using a 2 x 2 factorial design. Whereas ADG was not affected by any of the treatments, feed intake was decreased by the supplementation of enzymes from 1 to 21 d (P < 0.01) and from 1 to 35 d (P < 0.04). Feed gain ratio (g/g) was improved from 1 to 21 d (P < 0.01) by the enzyme supplementation and tended to be improved by the supplementation of Essential from 21 to 35 d (P = 0.09). Results from the digestibility study showed that the supplementation of the enzymes improved the AME (P < 0.001), AMEn (P < 0.001), and EE retention (P < 0.001). Also, enzyme supplementation tended to improve N digestibility (P = 0.08) and improved N retention (P = 0.02). Essential tended to increase N digestibility only when enzymes were supplemented (P = 0.08). In conclusion, although the supplementation of Essential did not positively affect any parameters in the metabolizability study, its supplementation in combination with xylanases and β-glucanases in wheat/barley based diets tended to improve N digestibility and performance.

Key Words: β-glucanase, xylanase, functional oil, performance, metabolizable energy

Reducing Escherichia coli colonization in artificially challenged turkey using a feed supplemented natural growth promoter product. Attila Kovács*1, Luca Vandi1, Paola Massi2, and Giovanni Tosi2, 1Biomin Holding GmbH, Herzogenburg, Austria. 2Istituto Zooprofilattico Sperimentale della Lombardia e dell’Emilia Romagna, Forli, Italy.

Supplementing feed with a natural growth promoter product can reduce E.coli counts in turkey intestinal tract. A 30-d trial was conducted to...
study the effects of dietary supplementation with a blend of formic, propionic and acetic acids combined with cinnamaldehyde and a permeabilizing substance (NGP, Biotronic Top3, Biomian, Austria) on the reduction of E. coli counts in turkey intestinal tract. From day of hatch, 60 BUT female turkey chicks were randomly assigned to 3 treatments of 20 chicks each and placed in isolators. A control group (NC) received a commercial diet with no antibiotic or NGP, trial group (NGP) received feed supplemented with 2 kg NGP/ton of feed and positive control group (PC) received antibiotic growth promoter (Enrofloxacin at 0.5 mL/L of water from d 11 to d 20) supplemented water. On d 10 the animals in all groups were orally challenged with E. coli O78 at a concentration of 1.38 × 10⁸ cfu/mL. The trial lasted for 30 d. Bacterial counts of the intestinal tract were recorded on d 20 and 30. The results (Table 1) of the NGP group showed a significant (P < 0.05) reduction of E. coli counts in the intestinal tract compared with NC and PC. The NGP supplemented diet significantly reduced E. coli counts in the intestinal tract of turkey.

Table 1. Bacterial counts in the intestinal tract of turkey at day 20 and 30 of the experiment (log cfu/g)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>NC</th>
<th>PC</th>
<th>NGP</th>
</tr>
</thead>
<tbody>
<tr>
<td>E. coli count d 20</td>
<td>7.42±0.78</td>
<td>7.24±1.18</td>
<td>6.22±0.83</td>
</tr>
<tr>
<td>E. coli count d 30</td>
<td>8.09±0.21</td>
<td>7.89±0.31</td>
<td>6.01±0.40</td>
</tr>
</tbody>
</table>

Values not sharing the same letter within a row were significantly different (P < 0.05).

Key Words: Escherichia coli, permeabilizing complex, organic acids, turkey

148 Response of laying hens to dietary yeast cell wall (Saccharomyces cerevisiae) supplementation. Natália T. G. Kotyama¹, Brunna G. S. Leite¹, Lúcio F. Araújo¹, Cristiane S. S. Araújo², Melina A. Bonato*², and Ricardo L. C. Barbalho¹, ¹Faculdade de Zootecnia e Engenharia de Alimentos, Universidade de São Paulo, Pirassununga, SP, Brazil; ²Faculdade de Medicina Veterinária e Zootecnia, Universidade de São Paulo, Pirassununga, SP, Brazil; ³ICC Industrial Comércio Exportação e Importação Ltda., São Paulo, SP, Brazil.

Although the effects of yeast cell wall are proven and the product is extensively used in broiler nutrition, its benefits are still poorly understood in laying hen nutrition. Based on this, one study was conducted to evaluate the effect of dietary supplementation of yeast cell wall on laying hen’s productive performance and egg quality. For this, 256 Hy-Line W-36 laying hens, from 22 to 70 weeks of age, were distributed in a completely randomized design with 4 treatments; 0, 0.225, 0.45 or 0.9 kg/MT of yeast cell wall product from Saccharomyces cerevisiae. Each treatment consisted of 8 replicates of 8 hens each. Birds received water and feed ad libitum, and the light program was 16 h per day. Feed intake (FI, g/d), egg production (EP, %), egg weight (EW, g), egg mass (EM = EP/100 × EW, g/d), feed conversion per dozen (FCD = FI / EP × 12, g/dozen), and feed conversion per egg mass (FCM = FI / EM, g/g) were evaluated. The egg quality parameters were also measured at each 28 d: albumen height (AH, mm), yolk color (YC), Haugh unit [HU = 100 × log (AH - 1.7 EW⁻⁰.₃⁷ + 7.6)], breaking strength (BS, kgf), and shell thickness (ST, mm). Data were analyzed using the GLM (SAS) and means compared by Tukey (P = 0.05). Yeast cell wall supplementation improved (P = 0.05) FI (96.24 vs. 93.51 g/d), EP (85.35 vs. 80.67%) and EM (50.97 vs. 48.27 g) at 0.45 kg/MT inclusion rate, when compared with control group. There was no significant difference (P > 0.05) between treatments for EW, FCD or FCM. Regarding egg quality parameters, laying hens fed yeast-added diets at 0.45 kg/MT had better (P < 0.05) AH (8.02 vs. 7.67 mm) and HU (88.65 vs. 86.54) compared with unsupplemented hens. However, YC was greater (P < 0.05) for control group hens, when compared with supplemented groups. For the parameters BS and ST, no statistical differences (P > 0.05) between treatments were found. This study demonstrated that yeast cell wall supplementation to laying hens at 0.45 kg/MT increased production performance (EP +5.8% and EM +5.6%) and internal egg quality (AH +4.6% and HU +2.4%) throughout the entire production period.

Key Words: egg production, egg quality, feed conversion, Saccharomyces cerevisiae supplementation

149 Effect of eubiotic administration to broiler feed on ileal morphology and microbiology under Clostridium perfringens challenge. Alaeldin Abudabos*, King Saud University, Riyadh, Saudi Arabia.

This study was conducted to assess the effect of prebiotics (TechnoMos), probiotics (GalliPro) and their combination on intestinal histomorphology and bacterial cell counts of broilers. A total of 240 one-day-old (Ross 308) birds were randomly assigned into 6 treatments with 8 replications (5 birds per replication). Chicks of group 1 (control group) were fed with diets that were not supplemented with the probiotic, prebiotic or antimicrobial growth promoter (AGP). The chicks of group 2 were fed with the control starter and finisher diets and the chicks were subjected to Clostridium perfringens challenge. The chicks of groups 3, and 4 were fed with diet 2 supplemented with 0.005 g, and 0.2 g of AGP and probiotics per kg feed, respectively. Chicks of group 5 were fed with the diet 2, plus 0.75g prebiotic per kg feed in the starter period and 0.6 g per kg in the finisher period. Chicks of group 6 were fed with diet 2, plus (0.2 g probiotic/kg + 0.6 g prebiotic/kg) for starter and (0.2 g probiotic/kg + 0.5 g prebiotic/kg) for the finisher period. Results showed that the birds that were challenged and were given AGP, probiotic, prebiotic or symbiotic had no lesions or hemorrhages. It can, therefore, be concluded that these supplements were helpful in reversing the negative effects of the bacterial challenge. Gram-negative bacilli were found to be the same among all groups (P > 0.05), which is an indication that the AGP, probiotic, prebiotic or symbiotic tested in this trial had no influence on gram-negative bacteria. The positive modulation in intestinal morphology and microbiology as observed in this study supported the concept that gut condition and function can be improved by dietary supplementation other than AGP.

Key Words: antimicrobial growth promoter (AGP), probiotic, prebiotic, symbiotic, Clostridium perfringens

150 Evaluation of different commercially available sulfonamide residues in commercial poultry before and after cooking. Haseeb Anvar* and Imran Mukhtar, Department of Physiology, Government College University, Faisalabad, Pakistan.

In the current study withdrawal periods of commonly used sulfonamides (sulfadiazine, sulfathiazole and sulfamerazine) were quantitatively compared in broilers (n = 45) using high performance liquid chromatography (HPLC) with UV detector. After acclimatization of 2 d, birds were divided into 3 groups: sulfadiazine (SD), sulfathiazole (ST) and sulfamerazine (SM). Sulfadiazine (60 mg/mL), sulfamerazine (100 mg/mL) and sulfathiazole (40 mg/mL) were given at a dose rate of 0.4 mL/L in drinking water for 5 consecutive days. At the end of the treatment, birds were slaughtered for 4 consecutive days in each group to collect muscle and liver samples. The HPLC was performed with a mobile phase comprised ammonium acetate (0.01 M) and acetonitrile (85:15 v/v). Twenty microliters of sample was injected at a flow rate of 1 mL/min at 266 nm wavelength. The data were compared using two-way ANOVA and DMR. No drug residue was found in ST and SM.
group at any sampling day; however, drug residues in meat and liver samples of SD group were found higher ($P = 0.05$) than the maximum residue limit until the 3rd day of sampling, depicting a withdrawal time of a minimum 3 d for SD. During second phase of study, the effect of electric oven (200°C for 40 min) and microwave cooking (900 W for 3 min) on SD residues in meat was evaluated. It was observed that both of the cooking methods reduced ($P = 0.05$) SD residues in meat samples.

**Key Words:** antibiotics, broiler, residue, sulfonamide, cooking

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### 152 Effects of a garlic product on growth performance, ileal characteristics, and serum immune parameters in broiler chickens

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The objective of the current experiment was to evaluate the effect of a garlic product on broiler chicken growth performance, ileal morphology and mucosal gene expression, and serum immune parameters. At 28-d post-hatching, male broilers were allotted on the basis of IBW (1.34 kg ± 0.106) in a RCBD to one of 6 treatments that consisted of administration of 0, 1, 2, 4, 8, or 16 mg garlic product per kg bodyweight with 8 replicates per treatment and 4 broilers per cage. The garlic product was administered by daily oral gavage for 6 d and broilers were fed a common grower diet with chronic oxide included as an indigestible marker. Growth performance was recorded and excreta were collected for subsequent analysis of DM, N, and E retention. Furthermore, on the last day of the experiment, the median bird in each pen was euthanized and the mid ileum was excised for morphological and gene expression measurements and blood was collected for serum natural antibody and complement assays. Mucosal gene expression was conducted by RT PCR for mucin (MUC2), interleukin 8 (IL-8), tumor necrosis factor (TNF-α), interleukin 6 (IL-6), claudin 1 (CL-1), occludin (OC), zonula occludens 1 (ZO-1), and zonula occludens 2 (ZO-2). Body weight gain was linearly increased ($P < 0.01$) with garlic supplementation but ADFI and feed efficiency were not affected. Furthermore, there was a linear increase ($P = 0.01$) in villous height with garlic supplementation but no effect of treatment on crypt depth. The breakpoint for BW gain and villous height were reached at a garlic intake level of 7.73 and 3.43 mg per kg BW, respectively. There was a quadratic effect ($P < 0.01$) of garlic supplementation on retention of DM, N, and E. Garlic supplementation had no effect on gene expression markers although there was a tendency for an increase ($P = 0.10$) in serum natural antibody activity due to treatment. Results from the current study indicate that supplementation of a garlic product improves BW gain and retention of DM, N, and E and affects ileal morphology and serum immune parameters in broiler chickens.

**Key Words:** broiler, garlic, growth, gene expression, nutrient retention