272  Cereal type and AME content affects broiler performance. Marta Martínez-Mora1, David Solá-Oriol2, Roser Sala1, Gemma González-Ortiz3, Michael R. Bedford2, and José F. Pérez1, 1Servei de Nutrició i Benestar Animal (SNIBA), Departament de Ciencia Animal i dels Aliments, Universitat Autònoma de Barcelona (UAB), Barcelona, Spain, 2AB Vista, Marlborough, United Kingdom.

A total of 448 1-d-old broiler chicks (Ross 308) were distributed by initial BW in a 2 × 2 factorial arrangement with cereal type (wheat; W vs corn; C) and AME content (high vs low) as main factors. Starter (s; 1 to 21 d; 22.9% CP and 1.25% Dig Lys) and grower (G; 22 to 42 d; 19.9% CP and 1.05% Dig. Lys) diets were formulated to contain 3.05 or 2.9 Mcal/kg and 3.2 or 3.05 Mcal/kg has high and low energy diets respectively. Feed was offered ad libitum in mash form. All diets were ground through a 0.5 mm screen and feed particle size distribution was determined as % of particles ≥2.0 mm, ≥1 mm, ≥0.75 mm, ≥0.5 mm and <0.5 mm and average particle size (D_m). Birds were weighed and feed disappearance recorded at 1, 21 and 42 d; feed intake (FI) and weight gain (WG) were measured and feed gain ratio (FGR) was calculated. Data were analyzed by ANOVA with cereal source and AME content as main factors. Wheat diets had a higher D_m (988W vs 768C μm) and corn diets had a larger % of particles that were less than 500 μm (18%W vs 24%C). For the S period, higher BW and WG (P < 0.05) were observed in birds with High AME diets, but no cereal effects were noted (P > 0.10). However, birds fed the W diets had a higher FI and WG (P < 0.05) in the G, and for the entire period (S+G). A positive effect on WG was also observed for the animals fed high AME content diets in the G period. However, the higher FI for the entire period observed for the animals fed the W diets, regardless for the AME content in the diet is possibly a result of the larger particle profile and distribution between W and C. It is concluded that particle size in broiler diets ground at Ω = 5 mm depends on cereal type, and this may affect broiler performance. Moreover, the increase in the dietary AME content from 2.9 to 3.05 Mcal/kg in S period, and from 3.05 to 3.2 Mcal/kg in G period also has a positive effect on performance, independent of the cereal type.

Key Words: corn, wheat, AME, particle size, broiler performance

273  The interaction of varying metabolizable energy levels and broiler strains on growth performance and processing yield. Garrett J. Mullenix*,1, Katie M. Hilton1, Justina Caldas1, Michael Schlumbom2, Judith A. England1, Antonio Kalinowski3, and Craig N. Coon1, 1University of Arkansas-Poultry Science, Fayetteville, AR, 2Evonik Nutrition & Care GmbH, Hanau, Germany.

Genetic progress in broilers has led to larger, leaner birds with an unknown metabolizable energy requirement. The objective was to establish how 2 modern broilers respond to dietary energy supply. Body weight (BW), average daily gain (ADG), feed conversion ratio (FCR), processing yields and protein turnover were evaluated. Two thousand 25 Cobb MX × Cobb 500 and Ross YP × Ross 308 were placed in 90 pens (n = 45 birds/pen) for the present study. Commercial starter and grower feeds were fed from 1 to 10 d and from 11 to 21 d, respectively. Five experimental finisher diets were fed from 22 to 42 d in pellet form (9 replicates per strain/diet). The test diets were formulated to different AME levels: 2,800, 2,925, 3,050, 3,175, and 3,300 kcal/kg. All diets were formulated to AMINOCHick2 recommendations, with dllys set at 1.00% and other amino acids set as a ratio to dllys: Met+Cys, 0.76; Thr:


The negative effects of protein fermentation due to high indigestible dietary protein fractions have been suggested to result in poor broiler performance. This study evaluated the effects of 3 dietary protein levels (24, 26 and 28%) with low or high indigestible protein (LIP, HIP) on the meat yield of broiler chickens. The trial was completely randomized, with a 2 × 2 × 2 factorial arrangement: dietary protein level, dietary indigestible protein and sex were the main factors. Ross 308 males (M, 1,944) and females (F, 2,232) were randomly assigned to 72 litter floor pens and fed 1 of 6 diets (24-LIP, 24-HIP, 26-LIP, 26-HIP, 28-LIP, 28 HIP) for 32 d. All diets were formulated to the same level of digestible methionine, had no medication and met broiler grower nutrient specifica.

On d 5, all birds were vaccinated with Cocccivac-B52, and on d 32, 24 birds per treatment were processed for meat yield. Differences were considered significant when P ≤ 0.05. Carcass yield was affected by CP level (28 > 26 > 24), digestible CP fraction (LIP > HIP) and sex (F > M). Dietary treatments and sex affected breast meat yield. An interaction between CP level and protein digestibility resulted in the 28 and 26% CP diets with LIP having higher breast yield than the 24% CP diet with LIP and all diets with HIP. F had a higher percent of whole breast yield compared with M. Breast skin decreased with increasing protein level and was higher in females than males. Whole drum weight was higher for birds fed LIP diets compared with HIP, with opposite effects on drum skin. Birds fed 26 and 28% CP had more drum meat than those fed 24% CP. Sex affected thigh weight, and M had more meat and bone, and less fat. Wing weight was not affect by treatment. Protein level (28 > 24) affected carcass weight after component removal. In conclusion, dietary protein level and the ratio of indigestible protein affected broiler meat yield when fed nutritionally balance diets.

Key Words: undigested protein, cocci-vaccination, antibiotic-free, chicken, meat yield
275 Effect of flaxseed oil and microalgae DHA-Gold on the production performance and fatty acid profiles of egg yolk and plasma in laying hens. Mohamed Neijat*, Okoyshe Ojekudo, and James D. House, University of Manitoba, Winnipeg, MB, Canada.

The incorporation of n-3 (omega-3) polyunsaturated fatty acids (PUFA) in the feed and the egg yolk is dependent on the transfer efficiency of preformed dietary n-3 fatty acids to the eggs as well as endogenous PUFA metabolism and deposition. Using an experimental design consisting of 70 Lohmann LSL-Classic hens (n = 10/treatment; 6-wk feeding trial), we examined the effect of including graded levels of either flaxseed oil (provider of precursor ALA) or DHA-GoldTM S 17B (a source of preformed docosahexaenoic acid, DHA), each at 3 inclusion levels: 0.20, 0.40 and 0.60% total n-3s. The control diet was a cereal-based diet principally devoid of both ALA and DHA. Study parameters included total and individual n-3s in egg yolk, measures of hen performance, eggshell quality, total cholesterol and fatty acid content of plasma. Data were analyzed as a complete randomized design using Proc Mixed procedure of SAS, considering each treatment group at 4 levels of total n-3 (with a separate control). No significant differences were observed between treatments with respect to hen performance, eggshell quality and cholesterol content in plasma and egg yolk. Individual and total n-3 PUFAs in the yolk and plasma increased (P < 0.0001) linearly as a function of total n-3 PUFA intake. At the highest inclusion levels, DHA-fed hens incorporated 3-fold more DHA in eggs compared with ALA-fed hens (179 ± 5.55 vs. 66.7 ± 2.25 mg/yolk, respectively). In both treatment groups, maximal enrichment of total n-3 PUFA was observed by wk 2, declined by wk 4, and leveled thereafter. In addition, accumulation of DHA in egg yolk showed linear (P < 0.0001) and quadratic (P < 0.01) effects for flaxseed oil (R2 = 0.86) and DHA-Gold (R2 = 0.93). The current data provide evidence that preformed DHA leads to greater enrichment of n-3 LCPUFA in eggs, and serves to highlight potential regulatory aspects explaining the limitations in the deposition of endogenously produced n-3 LCPUFA.

Key Words: egg yolk, fatty acid profile, flaxseed oil, DHA-Gold

276 Effect of altering dietary electrolyte balance using sodium bicarbonate and potassium carbonate on broiler breeder performance and egg shell parameters. John Halley*, Sandro Cerrate, Alejandro Corzo, and Bryan Fancher, Aviagen Inc., Huntsville, AL.

A study was performed altering the dietary electrolyte balance (DEB) to investigate the effects on broiler breeder performance and egg quality parameters. Ross 708 pullets and Ross YPM males were reared according to the 2014 Ross body weight standard. At 22 wk of age birds were randomly assigned to pens in a curtain-sided building with 3 treatments replicated 12 times each (70 hens with 7 males per pen). Treatment (Trt.) 1 was formulated to the Ross 2013 Nutrition Specifications. Trt. 2 was formulated to the same specifications except for the addition of sodium bicarbonate, while Trt. 3 utilized sodium bicarbonate as well as potassium carbonate. The DEB of the 3 diets was calculated to be sodium bicarbonate, while Trt. 3 utilized sodium bicarbonate as well. Trt. 1 was formulated to the Ross 2013 Nutrition Specifications. Trt. 2 was formulated to the same specifications except for the addition of sodium bicarbonate, while Trt. 3 utilized sodium bicarbonate as well as potassium carbonate. The DEB of the 3 diets was calculated to be sodium bicarbonate, while Trt. 3 utilized sodium bicarbonate as well as potassium carbonate. The DEB of the 3 diets was calculated to be sodium bicarbonate, while Trt. 3 utilized sodium bicarbonate as well as potassium carbonate.

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Key Words: egg yolk, fatty acid profile, flaxseed oil, DHA-Gold

277 Influence of particle size of the main cereal of the diet on egg production of brown laying hens. Jorge Herrera1, Beatrix Saldaña2, Pilar Guzmán2, Mohammad V. Kimiaeitab2, and Gonzalo G. Mateos2, 1Camar Agroindustria, S.L, Toledo, Spain, 2Departamento de Producción Agraria, Universidad Politécnica de Madrid, Madrid, Spain.

The influence of the geometric mean diameter (GMD) of the main cereal of the diet on productivity was studied in hens from 33 to 64 wk of age. The experiment was completely randomized with 6 dietary treatments arranged as a 3 × 2 factorial with 3 main cereals (barley, corn, and wheat) and 2 grinding sizes of the cereal (6 and 10 mm screen). Diets were isonutritive. Each treatment was replicated 11 times. Egg production, ADFI, egg weight, egg mass, and feed conversion ratio (FCR) were calculated by period of 28 d each, as well as for the entire experiment (33 to 64 wk of age). Also, egg quality traits (number of dirty, broken, and shell-less eggs, proportion of albumen, yolk, and shell, thickness, strength, and color of the shell) were measured. No interactions between main cereal and GMD of the diet were observed for any of the traits studied. Diet did not affect feed intake, egg production, FCR, or BW gain. Eggs were larger (P < 0.01) in hens fed the barley diet than in hens fed the corn or the wheat diet, probably because of greater level of supplemental fat of the barley diet. Dietary treatment did not affect any egg quality trait (P > 0.05). The GMD of the diet did not affect any variable studied. In summary, barley or wheat can substitute the corn in diets for laying hens supplemented with enzymes without any adverse effect on productivity. Consequently, the election of the main cereal of the diet will depend primarily on their relative cost. Within the range studied, screened size did not have any effect on hen productivity.

Key Words: barley, corn, laying hen, particle size, wheat


Mycotoxins are secondary toxic metabolites produced by fungi, exposure to which can impair health and adversely affect poultry performance. The objective of the current study was to determine the occurrence of mycotoxins in the 2015 corn crop in the United States of America and to assess the potential risk to poultry species. From September 2015 to January 2016, 381 corn samples were collected from 20 states as part of the annual Biomin Mycotoxin Survey. Samples were analyzed either by high performance liquid chromatography (HPLC) or liquid chromatography tandem mass spectrometry (LC-MS/MS) techniques which are highly sensitive in detecting very low mycotoxin concentrations. The major mycotoxin groups analyzed were aflatoxins (Afla), zearalenone (ZEN), trichothecenes including deoxynivalenol (DON) and T-2 toxin (T-2), fumonisins (FUM), and ochratoxin A (OTA). Mycotoxins were detected in 94% of the corn samples tested and 50% of the positive samples contained more than one mycotoxin. Co-occurrence of mycotoxins may lead to synergism and enhanced toxicity in animals which consume contaminated feed. The percent of positive samples, mean of positives (ppb), maximum of positives (ppb), and risk threshold (ppb)
for the 6 major mycotoxins are presented in Table 1. The occurrence of Afla, T-2 and OTA were minimal in relation to ZEN, DON, and FUM in these samples. The highest threat in these corn samples was posed by DON due to its high prevalence and number of samples above the FDA recommended level. As a result of their common co-occurrence, ZEN also presents a major threat. In terms of occurrence, FUM ranks second among the 6 major mycotoxins analyzed in these samples. With the increased occurrence and co-occurrence levels in 2015 compared with previous year, DON, FUM and ZEN pose a higher risk to livestock production in 2016.

Table 1 (Abstract 278). Results of the mycotoxin analyses on 2015 US corn samples

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Afla</th>
<th>ZEN</th>
<th>DON</th>
<th>FUM</th>
<th>OTA</th>
<th>T-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>% Positive</td>
<td>2</td>
<td>14</td>
<td>79</td>
<td>59</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Mean of positive samples (ppb)</td>
<td>2,688</td>
<td>615</td>
<td>765</td>
<td>2,891</td>
<td>367</td>
<td>200</td>
</tr>
<tr>
<td>Maximum of positive samples (ppb)</td>
<td>10,000</td>
<td>6,400</td>
<td>20,000</td>
<td>64,700</td>
<td>500</td>
<td>200</td>
</tr>
<tr>
<td>Risk threshold (ppb)</td>
<td>20</td>
<td>200</td>
<td>900</td>
<td>2,000</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Key Words: mycotoxin, deoxynivalenol, fumonisin, zearalenone, LC-MS/MS

279 Heat production and net energy of two broiler strains fed varying levels of metabolizable energy. Katie M. Hilton1*, Garrett J. Mullenix1, Michael J. Schlumberh1, Justina V. Caldas1, Judy A. England1, Antonio Kalinowski2, and Craig N. Coon1, 1University of Arkansas, Fayetteville, AR, 2Evonik Nutrition & Care Gmbh, Hanau, Germany.

The purpose of the study was to determine the interaction of dietary metabolizable energy (ME) and modern broiler strains on heat production and energy efficiency from d 22 to d 43. Two thousand 4 hundred and 30 chicks from 2 genetic lines (line A and line B) were fed 3 experimental diets starting on d 22. True metabolizable energy (TMEa) values of diets determined in vivo were 2,819, 3,137, and 3,452 kcal/kg. All diets were formulated to AMINOChick2 recommendations, with dLys at 1.0% and other amino acids set as a ratio to dLys: Met+Cys, 0.76; Thr: 0.65; Val: 0.80; Ile: 0.71; Arg: 1.05, and Trp: 0.16. Birds were moved to the respiratory chambers 1d before evaluation for a period of adaptation. Heat production (HP) kcal = 3.872 × VO2 (L/d) + 1.195 VCO2 (L/d) (Farrell, 1974) was measured for 1d. After HP was measured, fasting heat production (FHP) was measured for 24 h. Body composition was measured on d 22 and 42 by dual energy x-ray absorptiometry (DEXA). Data was analyzed using JMP Pro 12 (SAS, 2015). No difference between genetic lines was found on d 22 for HP. For 39–44 d, a significant interaction between line and diet, line B birds consuming 3,137 (kcal/kg) diet had higher (P = 0.04) HP. From d 22–43, line A gained more (P = 0.046) energy (kcal/bird) compared with line B. Birds fed increasing amounts of energy had lower feed intake (P = 0.0002), lower protein retention (protein intake/g body protein × 100, P < 0.001), and higher fat retention (fat intake/g body fat × 100, P < 0.001). Net energy of gain (NEg = protein grams × 5.66 + fat gain grams × 9.35), FHP, and heat increment (HI = HP-FHP) was not affected by dietary TMEa. Birds fed 3452 TMEa (kcal/g) level had significantly higher (P = 0.0163) net energy (NE = TMEa-FHP) than birds fed lower levels of energy. This study indicates that the response of heat production and NE is affected by increasing levels of TMEa.

Key Words: indirect calorimetry, heat production, net energy, body composition, metabolizable energy