
High levels of trypsin inhibitors (TI), one of the major anti-nutritional factors in SBM, can affect nutrient absorption and bird performance. Five soybean meals (SBM) ranging from 3,100 to 46,100 TIU/g were used in a performance trial to determine a threshold for trypsin inhibitors in the diet. The SBM products were grouped into 2 categories: cold pressed SBM and solvent extracted SBM. Of the cold pressed varieties (unheated), there was a ultra-low trypsin SBM (5,000 TIU/g), a low-trypsin SBM (16,000 TIU/g), and a heated and unheated commodity SBM (25,500 and 46,100 TIU/g respectively). The solvent extracted SBM was a heated commodity blend (3,100 TIU/g). A corn–SBM mash diet was formulated using determined TME and digestible AA values, and the CP and AA levels were 7.5% below NRC recommendations. SBM was included in the diet at 30%. The experiment used Cobb 500 x Hubbard M99 chicks from a commercial hatchery. The diets that contained up to 4,100 TIU/g did not have a significant effect on performance parameters of broilers over a 28-d period. From 0 to 14d of age, the effects of high TI (values over 9,100 TIU/g) in the diet negatively impacted body weight and feed intake, but not feed efficiency. Feed efficiency was not significantly different from 0 to 14 d of age, which may be due to physiological variation among the birds and between the pens. Body weight and feed intake significantly decreased (P < 0.05) from 0 to 21 d of age as TIU levels in the diet increased from 4,100 to 9,400 TIU/g. Feed intake was not significantly different for the first week of growth which was probably due to the feed conversion and the rate at which the birds grow. Pancreas weights increased in a linear fashion (P < 0.05) as TI levels in the diets increased from 0 to 28 d. Trypsin inhibitor levels over 9,100 TIU/g affect broiler performance the most when fed from 0 to 14 d of age, but not from 15 to 28 d of age. This may be due to the birds adapting physiologically to a diet high in trypsin inhibitors. Birds from 0 to 28 d seem to tolerate TI levels up to 4,100 TIU/g in the diet and perform normally.

Key Words: soybean meal, trypsin inhibitor, broiler

Nutritional evaluation of new reduced oligosaccharide soybean meal in poultry. X. Chen,* C. M. Parsons, and P. L. Utterback, University of Illinois at Urbana-Champaign, Urbana.

The nutritional value of a new reduced-oligosaccharide soybean meal (SBM-RO) and conventional SBM (SBM-CV) was evaluated and compared in 4 experiments. The first experiment was a true metabolizable energy (TME) assay with conventional roosters. The second experiment was a precision-fed cecectomized rooster assay to determine TME and amino acid digestibility. The third experiment was a standardized ileal amino acid digestibility (SIAAD) assay in which broiler chicks were fed semi-purified diets containing 20% protein (from only the test ingredient) for 17–21 d of age and ileal digesta were collected on Day 21. The fourth experiment was a growth performance trial (8 to 21 d of age) where broiler chicks were fed corn–SBM diets (2,937 ME/g, adequate in all AA) containing 38.84% SBM-RO or SBM-CV. The protein content (100% DM basis) of the SBM-CV and SBM-RO was 51.85% and 54.75%, respectively. The gross energy of the 2 SBM was similar. The TME values in both conventional roosters and cecectomized roosters were found to be significantly higher for SBM-RO than for SBM-CV (difference was approximately 200 kcal/kg DM). Amino acid digestibility in cecectomized roosters was statistically similar between SBM-CV and SBM-RO, with the exception of Trp, Ala, Asp and Cys (SBM-RO > SBM-CV, P < 0.05). No significant differences between the SBMs were found for AA digestibility in the SIAAD assay. In the growth performance trial (Experiment 4), the corn–SBM diet containing SBM-RO yielded significantly higher feed efficiency than the diet containing SBM-CV. The results indicated that the SBM-RO contains higher ME than the SBM-CV and that digestibility of AA in SBM-RO is similar or a slightly higher than SBM-CV.

Key Words: soybean meal, oligosaccharide, amino acid digestibility, metabolizable energy, growth performance

Growth performance and meat yield responses of broilers fed diets containing low oligosaccharide soybean meals from one to forty-two days of age. K. R. Perryman,*1 W. D. Berry1, H. A. Olanrewaju2, and W. A. Dozier III1, 1Auburn University, Auburn, AL, 2USDA ARS, Poultry Research Unit, Mississippi State, Starkville.

An experiment was conducted to determine the effects of broilers fed diets formulated with low oligosaccharide soybean meals (SBM) on growth performance, meat yield, and physiological variables during a 6 week production period. Fifteen hundred Ross × Ross 708 male chicks were randomly distributed to 60 floor pens (25 birds per pen; 0.09 m² per bird at 1 d of age). Birds were fed diets formulated with 1 of 3 SBM sources [conventional SBM (CSBM), low oligosaccharide SBM (LOSBM), or ultra-low oligosaccharide SBM (ULSBM)] and either moderate or reduced AME (25 kcal/kg) values in a 3 × 2 factorial treatment design. Diets were formulated using AME and ileal amino acid digestibility values determined from previous research utilizing the same SBM sources. Variables measured consisted of BW gain, feed intake, feed conversion ratio, mortality, incidence of pododermatitis, carcass characteristics, digesta viscosities and pH, and concentrations of free fatty acids, glucose, and triglycerides in blood plasma. Significant interactions and main effects of AME concentration were not observed between treatments. Feed conversion ratio was lower (P < 0.001) for birds fed diets containing ULSBM vs. LOSBM and CSBM from 28 and 1 to 42 d of age. Broilers fed diets formulated with ULSBM had higher (P < 0.05) carcass yield vs. birds fed diets with CSBM. Breast meat yield was higher (P < 0.021) for birds fed diets containing LOSBM and ULSBM vs. CSBM, and abdominal fat percentage was higher (P < 0.027) for birds fed diets containing LOSBM vs. CSBM. Incidence of pododermatitis was higher (P < 0.002) for birds fed diets containing CSBM compared with LOSBM and ULSBM. Diets formulated with ULSBM and LOSBM had 45 to 70% less oil inclusion compared with diets formulated with CSBM. These data indicated that no adverse growth or meat yield responses were observed for broilers fed diets formulated with low oligosaccharide soybean meals.

Key Words: soybean meal, oligosaccharide, broiler, AME


Nutrient digestibility in zero-tannin ‘Snowbird’ fava bean (FB), ‘Cooper’ field pea (PEA), and ‘Arabela’ lupin (LUP) compared with soybean meal (SBM) was determined in broilers at 15- and 29-d of age. On the day of hatch, male broiler chicks (Ross 308; n = 650) were distributed among 50 cages, which were divided into 2 groups, consisting of 32 or 28 cages that would be sampled on d 15 and 29, respectively. Birds in both groups were given access to 1 of 4 test diets for 7 d before sampling ileal digesta (d 15 or 29) in a RCB design with 8 and 7 replicate cages per treatment, respectively. Test diets consisted of 70% of a phase-specific basal concentrate, which included 2% celite, and 30% of 1 of the 4 test ingredients. For both age groups, digesta and excreta were pooled to produce a single specimen of each per test cage. Nutrient digestibility in the basal concentrates had previously been measured, thus permitting nutrient digestibility in the test ingredients to be calculated by the difference method. Digestibility coefficients were compared using the MIXED procedure of SAS 9.1. Models included test ingredient, age, and the 2-way interaction as fixed effects and block as the random term. Age interacted with test ingredient to affect ATTD of GE, DM, and AID of MET+CYS (P < 0.01). Except for LYS and THR, age did not affect AID of most AA (P > 0.10). The AID of LYS was greater on d 15, while AID of THR was greater on d 29 (P < 0.05). In general, AID of AA was greatest in SBM and lowest in PEA (P < 0.05). Except for MET, AID coefficients for most AA were similar between SBM and FB (P > 0.10). As expected, digestibility coefficients for MET were lower in FB, PEA, and LUP compared with SBM (P < 0.01). Digestibility of ILE, LYS and VAL in LUP was similar to FB, but lower than SBM (P < 0.05). Low AID of MET suggests broiler diets including PEA, FB or LUP require supplemental MET to achieve adequate digestible sulfur AA content.

Key Words: broiler, digestibility, faba bean, field pea, lupin


Optimal feed formulation and nutrition of farm animals requires information about the nutritional value of the feed ingredients used. Many nutritional criteria of ingredients are determined routinely but detection of heat damage occurring during processing of particular ingredients is still a challenge for the feed industry. Earlier research brought evidence that not only total content of certain amino acids but also the digestibility of remaining amino acids in certain ingredients change gradually with increasing degree of heat treatment. A concept has been developed to identify the effect of excessive heat treatment via a Heat Damage Indicator (HDI) and to adjust the ideal digestibility coefficients of dietary amino acids, which is combined to a Rapid Evaluation of Digestibility of amino acids (AMINORED). The method was already successfully validated in soybean meal and DDGS. The present studies investigated the validity in the extraction meals of the 2 other oil seeds, rapeseed and sunflower. Two trials with 10 to 28 old male broilers were performed in which quality rapeseed meal (RSM) or sunflower meal (SFM) were replaced by heat treated material of the same source either not considering effects on nutritional value (1:1 replacement) or balancing the diets on total amino acid basis according to analysis or adjusting amino acid levels on digestible basis. A 1:1 replacement resulted in impaired weight gain, feed conversion ratio, and breast meat yield. The dietary adjustment according total amino acids analysis partly recovered the performance decline while additional adjustment of the amino acid digestibility coefficients fully recovered performance to the level observed with good quality of the tested material. All differences were significant (P < 0.05) for RSM and numerical for SFM. It is concluded that AMINORED in RSM and SFM works well when applied in practical feed formulation.

Key Words: amino acid digestibility, broiler performance, feed formulation, oilseed


An experiment was conducted to determine the apparent ileal digestibility (AID) of amino acids (AA) of 4 commercial soybean meals (SBM) from USA (USA-1, 48.1% CP and USA-2, 46.2% CP), Brazil (BRA, 47.6% CP), and Argentine (ARG, 46.3% CP). In a second experiment, the effects of inclusion of these SBM in mash, crumble, or pellet diets on growth performance and total tract apparent retention (TTAR) of nutrients was studied in broilers from 1 to 25 d of age. In experiment 1, AID of Lys was higher for the USA-2 meal than for the BRA meal, with the USA-1 and ARG meals being intermediate (89.0 vs. 85.0 vs. 87.7 and 88.0%; P < 0.05). In experiment 2 (a battery study), 12 diets were arranged as a 3 × 4 factorial with 3 feed forms (mash, crumbles, and pellets) and the 4 sources of SBM used in experiment 1. All diets were isonutritive per unit of energy and the AID of the AA of the SBM obtained in experiment 1 were used for feed formulation. The AMEn content of the SBM was calculated based on the World’s Poultry Science Association (1986) equation (AMEn kcal/kg DM = 15.69 × CP + 19.41 × crude fat + 6.236 × nitrogen-free extract). No interactions between SBM source and feed form were detected for any of the growth performance traits studied. From 1 to 25 d of age, chicks fed mash had lower (P < 0.001) ADFI (52.0 vs. 58.1 or 62.7 g) and ADG (31.4 vs. 36.8 or 38.7 g) and poorer (P < 0.01) feed to gain ratio (1.66 vs. 1.58 or 1.62) than chicks fed crumbles or pellets. Source of SBM did not affect growth performance of broilers. The TTAR of DM and OM was similar for all feed forms but for GE retention was higher (P < 0.01) in birds fed pellets than in birds fed mash or crumbles. The results indicate that crumbling and pelleting of the diets improved growth performance of broilers from 1 to 25 d of age but had little effect on nutrient retention. Diets formulated with analyzed rather than calculated AID of AA of the SBM source resulted in similar growth performance of broilers. Therefore, the nutritive value of SBM should be evaluated before its use in feed formulation.

Key Words: amino acid digestibility, broiler performance, feed form, organ size, soybean meal source
The cost of energy contributing ingredients have increased dramatically over the last several yr. Defining minimum dietary energy specifications for broilers is a strategy to mitigate high diet cost. Two experiments were conducted to evaluate the effects of diets with graded concentrations of AMEn, fed to Hubbard × Cobb 500 (experiment 1) and Ross × Ross 708 (experiment 2) male broiler chicks from 14 to 28 d of age. Both experiments were identical in experimental procedures with the exception of genetic strain. In each experiment, 1,500 (25 per pen; 0.09 m² per bird) broiler chicks were randomly distributed to 60 floor pens (10 replicates per treatment). Broilers were fed a common corn-soybean meal-based starter diet (3,075 kcal/kg AMEn and 1.22% digestible Lys) from 1 to 13 d of age. At 14 d of age, dietary treatments were provided with one of 6 concentrations of AMEn (3,000, 3,030, 3,060, 3,090, 3,120, and 3,150 kcal/kg). In experiment 1, BW gain of Hubbard × Cobb 500 male broilers fed diets containing progressive concentrations of AMEn decreased linearly (P = 0.02) concurrently with feed intake (P < 0.01) and feed conversion ratio (P = 0.05). Conversely, caloric conversion increased linearly because of the reduction of feed intake and BW gain with increasing AMEn. Optimum feed conversion ratio was estimated (P < 0.01) at 3,062 kcal AMEn/kg based on broken-line methodology. In experiment 2, Ross × Ross 708 broilers did not respond to graded concentrations of energy as indicated by linear and quadratic regression of BW gain, feed intake, caloric conversion and feed conversion ratio data (P > 0.05). These data indicated that Hubbard × Cobb 500 male broilers respond to AMEn from 14 to 28 d of age and may be fed diets formulated at 3,062 kcal AMEn/kg without loss of performance. Conversely, growth performance of Ross × Ross 708 male broilers was not affected by varying AMEn (3,000 to 3,150 kcal/kg) from 14 to 28 d of age.

Key Words: metabolizable energy, broiler, fat


The influence of AMEn concentration of the diet on productive performance and egg quality was studied in Hy-Line brown egg-laying hens differing in initial BW from 24 to 59 wks. There were 8 dietary treatments arranged factorially with 4 AMEn concentrations (2,650, 2,750, 2,850, and 2,950 kcal of AMEn/kg) and 2 initial BW (1,733 vs. 1,606 g) of the hens. Each treatment was replicated 5 times (13 hens per cage) and all diets had similar nutrient content per unit of energy. Productive performance was recorded every 28-d and egg quality was measured at 39, 48, 55, and 59 wk of age. No significant interactions between main factors were detected for any of the variables studied and therefore, only main effects are presented. An increase in AMEn concentration of the diet increased egg production, egg mass, energy efficiency per gram of eggs (linear, P < 0.05; quadratic P < 0.05), AMEn intake (linear, P < 0.001), and BW gain (P < 0.05). However, ADFI (linear, P < 0.001) and FCR per kilogram (linear, P < 0.01; quadratic P < 0.01) and per dozen of eggs (linear, P < 0.05; quadratic P < 0.05) decreased as the AMEn content of the diet increased. Egg weight, egg mass, feed intake, FCR per dozen of eggs, and AMEn intake were higher for the heavier than for the lighter hens (P < 0.01 but energy efficiency was similar. The AMEn content of the diets affected most egg quality traits. Eggs from the heavier hens had higher proportion of yolk and lower of albumen (P < 0.01) than eggs from the lighter hens. It is concluded that increasing the levels of energy of the diet from 2,650 to 2,950 kcal AMEn/kg affected equally productive performance and egg quality of the 2 groups of Brown egg-laying hens, irrespective of initial BW and do not need more than 2,750–2,850 kcal AMEn/kg to maximize egg production and egg weight provided that the diets are balanced for AA and other nutrients. Heavier hens had higher feed intake and produced more egg mass than lighter hens. However, lighter hens had lower AMEn intake and better energy efficiency than heavier hens.

Key Words: energy, egg quality, initial BW, laying hen performance


A major issue in the utilization of Corn Distillers Dried Grains with Solubles (DDGS) in broiler diets is the high variation of nutrient quality that mainly reflects different processing technologies. Contrary to protein quality, only few studies reported variations in the energy value of DDGS. The main objectives of this work were to investigate variations in apparent metabolizable energy corrected for nitrogen balance (AMEn) of different corn DDGS using 23 d old broilers. Twenty 2 corn DDGS samples were collected from major bioethanol plants in the US. Samples were analyzed for dry matter (DM), crude protein (CP), fat, crude fiber (CF) and ash. They were also analyzed for their absorbances in the Near Infrared (NIR). Experiments were designed to determine AMEn with ad libitum feeding and total excreta collection using the European Reference Method (Bourdillon et al., 1990). A corn-soybean meal basal diet was used in all treatments. Evaluation of corn DDGS was done by substituting 25% of the basal diet. Results showed that the AMEn of the 22 corn DDGS samples ranged from 2,196 kcal/kg DM to 3,420 kcal/kg DM and had a mean value of 2,827 ± 331 kcal/kg DM. Among the 22 samples, 6 were classified as high protein type corresponding to an AMEn average value found at 2,989 whereas the standard deviation AMEn type corresponded to a mean value of 2,729 kcal/kg DM. Equations to estimate AMEn in vivo measurements on the basis of proximate characteristics were developed with single CP, fat, CF and ash or in combination. Our results indicated that the best relation was found by combining fat and CF but with a rather low correlation (R² = 0.39). By contrast, tentative model for correlating NIR absorbances to AMEn measurements, explained 86% of the variations, with a standard error of the model of 110 kcal/kg DM. Variations in AMEn values indicated that corn DDGS must be qualified in term of AMEn prior being used to formulate broiler feeds. When completed by additional works, NIR model could help differentiating corn DDGS qualities.

Key Words: corn DDGS, energy, broilers, near infrared
As corn origin ethanol production increases, additional amounts of corn distillers dried grains with solubles (DDGS) are becoming available to the poultry industry. DDGS may be further processed to extract oil. The residual material is called low-oil DDGS (LO-DDGS). This study consisted of 2 steps; 1) evaluating the nutritional composition of LO-DDGS; and 2) an economic analysis using Ewtonik Degussa AA digestibility values and average 2010 ingredient prices. Ethanol plants throughout the US were surveyed and the ones that were currently extracting oil were contacted. Ten different LO-DDGS samples were collected. Proximate composition analysis results showed that most LO-DDGS samples have a crude fat value between 7% and 8% (vs. 9% traditional DDGS), a crude protein value between 27 and 29% (vs. 27% traditional DDGS). True metabolizable energy (TME) values were determined using conventional precision-fed rooster assays. Average TME value was 2,988 kcal/kg. Average particle size was 705 microns. The feed formulation model simulated DDGS and LO-DDGS inclusion in common chicken and turkey diets to determine relative DDGS and LO-DDGS shadow prices. The nutrient requirements were taken from commercial breeder management guides. The market prices used in the model for corn, soybean meal and poultry fat were $286, $336, $880, respectively. Economic analysis results showed that DDGS shadow price was lowest in turkey starter diet ($219) and highest in layer prelay diet ($284) while LO-DDGS shadow price was lowest in turkey starter ($292) and highest in layer peak diet ($324). The highest shadow prices were in commercial layer diets, making LO-DDGS inclusion more affordable in layer diets compared with commercial broiler ($312), broiler breeder starter ($303) and turkey finisher ($297) diets. Most ethanol facilities will eventually consider extracting oil from DDGS, but the expanse of the industry is not well known. However, differences in feed cost from using the different percentages of LO-DDGS can estimate potential savings to the American poultry industry.

**Key Words:** low-oil DDGS, proximate composition, oil extraction, economic analysis

As ethanol production increases, additional corn distillers dried grains with solubles (DDGS) are available to the poultry industry. A typical DDGS might have up to 12.8% oil content. Corn oil in DDGS is now being extracted from DDGS. The left-over product after oil extraction is called low-oil DDGS (LO-DDGS). This study evaluated the nutritional impact of LO-DDGS in 3 different steps. The first step was to evaluate the nutritional composition of LO-DDGS. Ethanol plants throughout the US were surveyed and the ones that were currently extracting oil were contacted. Ten different LO-DDGS samples were collected from these plants. Proximate composition analysis results show that most LO-DDGS samples have a crude fat value between 7% and 8%, a crude protein value between 27 and 29%. Average TME value is 2,988 kcal/kg. Average particle size is 705 microns. The second step was to evaluate the impact of LO-DDGS inclusion on layer performance and egg quality. 150 Hy-Line W-36 layers were assigned to the 5 treatments. The treatments were control diet (Corn-SBM), diets containing 2 levels of traditional DDGS (10 and 20%), and 2 levels of LO-DDGS (10 and 20%). Ten replicate units of 3 hens were fed each experimental diet for 20 to 40 weeks of age. Egg specific gravity and weight gain of birds receiving 20% LO-DDGS were lower than those fed 10% LO-DDGS (P < 0.05). The third step was to evaluate the impact of LO-DDGS inclusion on broiler performance. 630, one-d-old, chicks were randomly assigned to the 7 treatments. The treatments were control diet (Corn-SBM), diets containing 2 levels of traditional DDGS (10 and 20%), 2 levels of LO-DDGS (10 and 20%), and 2 levels of another DDGS (10 and 20%). Six replicate pens containing 15 chicks were fed each experimental diet from 0 to 18 d of age. LO-DDGS can be used up to 10% successfully in broiler and layer diets if the oil level and AA digestibility levels are taken into account when formulating the diets. The concern is that most ethanol facilities will consider extracting oil from DDGS and result in even greater variability of DDGS.

**Key Words:** low-oil DDGS, crude fat, oil extraction, broiler, layer

As corn origin ethanol production increases, additional amounts of corn distillers dried grains with solubles (DDGS) are available to the poultry industry. A typical DDGS might have up to 12.8% oil content. Corn oil in DDGS is now being extracted from DDGS. The left-over product after oil extraction is called low-oil DDGS (LO-DDGS). This study evaluated the nutritional impact of LO-DDGS in 3 different steps. The first step was to evaluate the nutritional composition of LO-DDGS. Ethanol plants throughout the US were surveyed and the ones that were currently extracting oil were contacted. Ten different LO-DDGS samples were collected. Proximate composition analysis results showed that most LO-DDGS samples have a crude fat value between 7% and 8% (vs. 9% traditional DDGS), a crude protein value between 27 and 29% (vs. 27% traditional DDGS). True metabolizable energy (TME) values were determined using conventional precision-fed rooster assays. Average TME value was 2,988 kcal/kg. Average particle size was 705 microns. The feed formulation model simulated DDGS and LO-DDGS inclusion in common chicken and turkey diets to determine relative DDGS and LO-DDGS shadow prices. The nutrient requirements were taken from commercial breeder management guides. The market prices used in the model for corn, soybean meal and poultry fat were $286, $336, $880, respectively. Economic analysis results showed that DDGS shadow price was lowest in turkey starter diet ($219) and highest in layer prelay diet ($284) while LO-DDGS shadow price was lowest in turkey starter ($292) and highest in layer peak diet ($324). The highest shadow prices were in commercial layer diets, making LO-DDGS inclusion more affordable in layer diets compared with commercial broiler ($312), broiler breeder starter ($303) and turkey finisher ($297) diets. Most ethanol facilities will eventually consider extracting oil from DDGS, but the expanse of the industry is not well known. However, differences in feed cost from using the different percentages of LO-DDGS can estimate potential savings to the American poultry industry.

**Key Words:** low-oil DDGS, proximate composition, oil extraction, economic analysis
130 **Lignosulfonate pellet binder and fat increase broiler feed retention time.** M. E. Lemons,* K. G. S. Wamsley, A. E. Lamp, A. M. Evans, K. J. Shipe, and J. S. Moritz, *West Virginia University, Morgantown.*

High dietary fat inclusions added at the mixer deteriorate pellet quality and lignosulfonate pellet binders have been shown to ameliorate these effects. In addition, previous research at West Virginia University found that a lignosulfonate pellet binder and 3% mixer-added fat (MAF) improved amino acid digestibility in a rooster model. Further research demonstrated that the same lignosulfonate pellet binder contributed to increased poult performance from 10 to 38d. The objective of the current study was to determine if feed retention time of the aforementioned diets using a broiler chick model differed, thus helping to explain differences in amino acid digestibility and poult performance. Dietary treatments fed to these poult’s were arranged in a 2x2 factorial design using main effects of amino acid density (Normal or High) and manufacturing technique (3% MAF+Binder or 1% MAF without binder). Thirty-two pens containing 5 Cobb 500 chicks were randomly assigned one of 4 ground diets and provided a 7d transition period. Feed was withheld for 24h and then chicks were given 450g of diet with 0.5% cellulose (an acid insoluble ash (AIA)) for 2h. Excreta collections began 2h after providing diets containing 0.5% AIA and continued every 2h for the following 14h, then every 6h for the following 18h post-0.5% AIA. Upon completion of excreta collection, chick and gizzard weights were found to be unaffected by diet. Amino acid density effects were minor. Chicks fed diets utilizing 3% MAF+Binder had greater feed intake (P = 0.045) of diets containing 0.5% AIA; but also excreted less AIA at 2, 4, 6, 10, 14, 22, and 28h post-AIA administration (P < 0.05). These data suggest that 3% MAF+Binder increased retention time in the broiler gastrointestinal tract and could explain previous improved poult performance via greater time for nutrient digestion and absorption. Although MAF and Binder effects are confounded, their combined use has a practical application and has been shown to be beneficial to both feed manufacture and feeding.

**Key Words:** lignosulfonate pellet binder, feed retention time, turkey diets, mixer-added fat

131 **Effect of roller mill ground corn inclusion and litter type on broiler performance, gastrointestinal and litter characteristics, and nutrient apparent ileal digestibility.** Y. Xu,* C. Stark, P. Ferket, and J. Brake, *Department of Poultry Science, North Carolina State University, Raleigh.*

Previous research has shown that the addition of coarse corn improved broiler live performance. The objective of this study was to evaluate the effect of coarse corn and litter type on broiler performance. The experiment was a 2 x 2 factorial of 2 coarse corn (CC) levels (0 and 50%) and 2 litter forms (finely ground old litter and new wood chip litter). A total of 1024 d-old male broiler chicks were randomly assigned to one of 4 treatments with 8 replicate pens per treatment and 32 birds per pen. The fine corn (FC) and SBM were ground with a hammermill (3.4 mm screen, 294 and 491 microns dgw, respectively) while the CC was ground with a roller mill (1359 microns dgw). The same starter diet was fed as a crumble contained 100% FC, and the grower and finisher diets were fed as a pellet with the fines removed contained either 100% FC or a combination of FC and 50% CC. Feed intake (FI) and BW were determined at 14, 35, and 49 d of age and adjusted feed conversion ratio (AdjFCR) was calculated by including BW of all dead birds. Fecal nitrogen (N), moisture, and pH were measured at 49 d. The results showed no difference in FI or BW at 49 d of age. There was an improvement in AdjFCR at 35 d (1.65 vs. 1.70, P < 0.01) and 49 d (1.86 vs. 1.92, P < 0.01) of age for the birds fed the 50% CC as compared with 100% FC, respectively. No litter effect was detected on live performance. Fecal N was 8.47% lower (3.78 vs. 3.56%, P < 0.01) and fecal pH was higher (8.36 vs. 8.45, P < 0.05) in 50% CC treatment. The AID (apparent ileal digestibility) of gross energy and nitrogen measured at 49 d were improved (6.8%, P < 0.01 and 3.5%, P = 0.03, respectively) in 50% CC treatment. The absolute gizzard and relative jejunum weight (g/cm) were heavier in 50% CC treatment (P < 0.01 and P < 0.01, respectively). The results of this study indicated that birds fed pelleted and screened diets that contained 50% CC had improved AdjFCR with no difference in FI or BW. The addition of 50% CC also improved AID of gross energy and nitrogen and reduced fecal N in the litter.

**Key Words:** corn particle size, broiler, pellets, gizzard, AID

132 **Pelleting does not decrease lysine digestibility.** K. J. Shipe,* A. M. Evans, K. G. S. Wamsley, and J. S. Moritz, *West Virginia University, Morgantown.*

Lysine has been indicated as a nutrient with potential to be structurally altered, especially in the presence of heat and reducing sugars, as in Maillard reactions, that decreases nutrient availability. A practical broiler finisher diet containing 7.5% bakery by-product meal and 0.13% lysine HCl was formulated to 90% lysine recommendations of Cobb-Vantress to best demonstrate lysine availability differences when manufactured and fed. This diet was utilized in a 2x2x2 factorial design that evaluated the effects of production rate (0.5 or 0.8 tonne/hr), die thickness (38.1 or 44.5 mm), and mixer-added fat (MAF) level (0.5 or 3%) on feed manufacture, broiler performance, and carcass characteristics. Two additional treatments: unprocessed mash and double pelleted (exposed twice to 0.5 tonne/hr production using a 44.5mm die after 0.5% MAF) were also manufactured and fed. All diets, excluding mash, were steam conditioned at 82°C. Bird performance and carcass characteristics were not affected by main effects (P > 0.05); however, contrasts demonstrated that mash fed birds had decreased feed conversion ratio (FCR) compared with double pelleted fed birds, with birds fed diets from the factorial treatments being intermediate (P < 0.05). The objective of the current study was to determine if the mechanism of action responsible for the FCR effects included lysine digestibility. Diets were analyzed for fural, an intermediate of the Maillard reaction pathway, and assessed using cecotomized roosters. Furfural concentration was not altered due to processing treatment (P > 0.05). In addition, no differences in lysine digestibility or the digestibility of any other tested amino acid were apparent (P > 0.05). Therefore lysine digestibility does not appear to be decreased due to pelleting. Perhaps FCR differences were a result of cell wall carbohydrates in corn and soybean such as xylene being liberated due to thermal processing, thereby increasing digesta viscosity and decreasing overall broiler performance.

**Key Words:** lysine, true amino acid digestibility, furfural, pelleting, Maillard reaction

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The effect of pasture access, breed, and diet on laying hen health, performance, and EPA and DHA content of eggs. A. E. Lamp,* M. E. Lemons, K. G. S. Wamsley, and J. S. Moritz, West Virginia University, Morgantown.

Previous research from WVU assessed the effect of pasture and marine oil inclusion of diets on Hyline W36 (H36) eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) egg composition. Pasture access and a 1% marine oil inclusion were found to enhance EPA and DHA content of eggs without decreasing consumer acceptability. The objective of the current study was to determine if this same diet formulation would produce an enhanced EPA and DHA egg composition when pasture access and hen breed varied. This study utilized a split-plot design with housing as the whole plot unit (pasture or conventional without pasture) and a factorial arrangement of treatments applied to subplot pens (2 Breed (H36 or Red Sex Link) x 2 Diet (1% Marine oil (Marine) or 1% soybean oil (Basal)). Diets were similar with the exception of oil source. Marine oil contained 18% EPA and 12% DHA. Each day throughout the experimental period (48–53wks), eggs were collected and weighed. Hen performance, hen health through serum chemistry, and fatty acid composition of eggs were measured. Diet had no effect on performance ($P > 0.05$). Egg EPA content was affected by a House x Diet interaction ($P < 0.05$) demonstrating that hens fed Marine had elevated EPA; however, the increase was greater when hens were conventionally housed without pasture. Egg DHA content was affected by Diet ($P < 0.0001$), showing increased DHA when hens were fed Marine compared with Basal (123 vs. 46 mg/egg, respectively). Health assessment through serum chemistry was primarily inconclusive due to lack of definitive research supporting abnormal parameters for these breeds. However, a measure of hepatocellular damage in poultry, Aspartate Amino Transferase (AST) activity, was affected by a House x Breed interaction ($P < 0.0001$) describing that H36 hens had elevated AST activity (279U/L) when housed conventionally without pasture. These data show that egg EPA and DHA content can be influenced by both diet and housing system as defined by pasture access.

**Key Words:** marine oil, EPA, DHA, pasture access