9 Intestinal nutrient transporter gene expression in broiler chickens fed methionine isomers or precursors. Shuai Zhang*1, Behnam Saremi2, Elizabeth R. Gilbert1, and Eric A. Wong1, 1Virginia Tech, Blacksburg, VA, 2Evonik Industries AG, Hanau, Germany.

To determine the effect of dietary methionine supplementation on intestinal amino acid/peptide/monocarboxylic acid transporter gene expression, a total of 242 male Cobb-500 broilers were fed from day of hatch to 35 d of age using a basal diet deficient in sulfur amino acids (control), or the control diet supplemented with dl-methionine (dl-Met), l-methionine (l-Met) or methionine analog dL-2-hydroxy-4-(methylthio) butanoic acid (dL-HMTBA) to meet requirements. Duodenum, jejunum, and ileum were collected at d 0 (d0), d3, d5, d10, d21, d26 and d35 (n = 5). The mRNA abundance of 13 transporter genes ATB0,+, b0,+AT, B0AT, LAT1, MCT1, NHE3, PepT1, rBAT, SAT1, SAT2, SAT3, y LAT1 and y LAT2 was assayed by real time PCR and expression data were calculated using gbase+. The statistical model included the main effects of treatment, age, small intestinal segment and their interactions. Data were analyzed by ANOVA using JMP 10.0. Means were separated using Tukey’s test. When compared among different segments, ATB0,+, b0,+AT, B0AT, LAT1, rBAT, SAT1, SAT2, SAT3, y LAT1 and y LAT2 had their highest expression in ileum, while SAT2, MCT1, NHE3 and PepT1 had the highest expression in duodenum. There was an age dependent effect in expression of the transporters. When analyzed within each segment, there was no significant difference between different levels or sources of methionine. In conclusion, dietary supplemental methionine sources altered minimally the expression of intestinal nutrient transporter genes in broiler chickens.

Key Words: l-Met, dl-Met, HMTBA, transporter, chicken

10 Effect of methionine supplementation on broiler yields. Ayoola A. Onafowokan*1, Rocky Latham1, Rob B. Shirley2, Nickki Sriperm2, Jason Lee1, and Christine Alvarado1, 1Department of Nutrition and Food Science and Technology, Texas A&M University, College Station, TX, 2Aidisseo, Alpharetta, GA.

This experiment was conducted to determine the digestible total sulfur amino acid (dTSAA) requirement of male Cobb 500, using yield data. Seven dTSAA levels were formulated from 0.491 to 0.882%, in increments of 0.065%, by adding dl-methionine (dl-Met) to a basal diet that contained 0.90% digestible lysine (dLys). An additional treatment evaluated the 100% bioavailability of 2-hydroxy-4-(methylthio) butanoic acid (HMTBA: Rhodimet AT88) when formulated to a dTSAA level of 0.687%. Birds were located in a randomized complete block design with 21 birds per pen and 13 replications after 35 d to assure an equivalent BW distribution between treatments. At 49 d, 6 birds per pen were randomly selected and processed at d 50. Carcasses were chilled at 4°C for 80 min, and drained for 15 min before being weighed and deboned. The evaluated parameters were fasted live weight, chilled carcass weight, total white meat (pectoralis major and minor), total dark meat (thigh and drumsticks), wings, and frame. The yield of these parts was based on a fasted live weight. In addition to yield, breast myopathies were also evaluated. The data were analyzed using PROC MIXED model of SAS (2004), and included the incidence of woody breast and block as a random effect. The dTSAA requirements were determined with a quadratic broken-line model using ProcNLIN. Results indicated chicken breast myopathy had a significant effect on the yield of various parts, except for wings and frame (P < 0.05). An increase in dTSAA levels had a positive effect on total white meat yield (P < 0.05), and no effect on total dark meat, wings, or carcass yields (P > 0.05). As such, the dTSAA requirement that maximize total white meat yield was 0.837%. There were no significant differences between methionine sources for the measured parameters, except for wings and total dark meat. These results indicate that broilers respond to increasing levels of methionine, and the bioavailability value of Rhodimet AT88 is 100%.

Key Words: methionine requirement, breast myopathies, meat yield

11 Using regression to predict the optimal dietary digestible lysine: true protein balance for broiler chickens. Rashed A. Alho-tan* and Gene M. Pesti, University of Georgia, Athens, GA.

Meeting the requirements of the essential amino acids (EAA) has been a common practice during feed formulation without taking into account the importance of providing sufficient amounts of the nonessential amino acids (NEAA), which are required to maximize performance. The requirements of all amino acids (EAA and NEAA) can be most accurately accounted for when true protein (TP) values in relation to EAA are included in feed formulation models. The objective of this study was to perform a meta-analysis to estimate the optimal balance between digestible lysine (dLys) and the TP and CP contents of broiler feeds. Dose-response data for body weight gain (BWG) and feed conversion ratio (FCR) obtained from recent research pertaining to the dLys requirements were compiled from the world’s literature. Using common ingredient composition values, the dLys requirements for each experiment were re-calculated and the TP and CP contents were estimated. The data were fitted using Broken line linear (BLL) and broken line quadratic (BLQ) models. The dLys requirements of broilers for BWG and FCR increased linearly as the dietary TP and CP increased. Neither sex nor age of the chickens had an effect on these relationships. The dLys requirements for BWG and FCR were found to decrease (P < 0.01) as chickens age. However, when examined as a ratio to TP, the dLys requirements did not change with age for BWG (P = 0.14) or FCR (P = 0.68). The dLys requirements as estimated by the BLL model were predicted using regression to be 5.17% ± 0.04 (for maximum BWG) and 5.29% ± 0.06 (for minimum FCR) of the dietary TP. Whereas, the dLys requirements estimated by the same model were predicted to be 4.70% ± 0.04 (for maximum BWG) and 4.80% ± 0.06 (for minimum FCR) of the dietary CP. The coefficient of determination suggested a better prediction for the dLys requirements when TP was the predictor compared with CP. The good linear fit should help predicting the dLys requirement from TP (and vice versa) which can be used in feed formulation models to represent the requirements of both EAA and NEAA.

Key Words: broiler, amino acid, lysine, true protein, crude protein

12 Effects of glycine and glutamine supplementation to low crude protein diets on growth performance and processing yields of male broilers during a 40-day production period. Ruben Kriseldi*1, Paul B. Tillman2, Zhirong Jiang3, and William A. Dozier III1, 1Auburn University, Auburn, AL, 2Poultry Technical Nutrition Services LLC, Burton, GA, 3Ajinomoto Heartland Inc., Chicago, IL.

Glycine supplementation has been reported to ameliorate poor performance of broilers fed low CP diets during the first weeks posthatching, but it is unclear if this response is due to Gly or nitrogen contribution. An experiment was conducted to determine the effects of feeding low CP diets supplemented with Gly and/or Gin on growth performance and carcass characteristics during a 40 d production period. One thousand 6
hundred Ross × Ross 708 male chicks were distributed to 64 floor pens (25 birds/pen). Broilers were randomly fed 1 of 8 treatments (TRT, 8 replications/TRT). In addition to a positive (PC) and negative control (NC), 6 TRT diets were formulated with intermediate concentrations of Gly+Ser, CP, or a combination of both. Glycine was added to increase Gly+Ser, while Gln was added as nitrogen source to increase CP. This was accomplished by adding Gly and/or Gln to the NC diet at either 33 or 66% of the difference in Gly+Ser or CP between the PC and NC diet. The TRT structure was as follow: (1) NC; (2) NC+33% Gly; (3) NC+66% Gly; (4) NC+33% Gln; (5) NC+66% Gln; (6) NC+33% Gly and Gln; (7) NC+66% Gly and Gln; (8) PC. Diets were formulated to contain 1.25, 1.10, and 1.00% digestible Lys in the grower, starter, and finisher periods, respectively, with optimum ratios of TAA, Thr, Val, Ile, Arg, and Trp. A 2.5% reduction in CP was formulated between the NC and PC diets. Birds fed the NC diet had higher (P < 0.05) cumulative feed conversion ratios (FCR) than birds fed the PC diet. Broilers fed diets supplemented with both Gly and Gln at 33% and 66% to the NC diet had similar (P > 0.05) cumulative BW gain and FCR to birds receiving the PC diet, but poorer (P < 0.03) cumulative FCR were observed when 33% Gly or Gln diets were fed. Broilers fed TRT 7 had higher (P < 0.05) breast meat yield (25.5%) than TRT 3 (24.9%) but were not different (P > 0.05) compared with birds receiving the PC diet. These results indicated that the addition of Gly and Gln (nitrogen source) to a low CP diet alleviated the adverse effects on growth performance of broilers.

Key Words: glycine, glutamine, broiler

13 Determination of the total sulfur amino acid requirement of the Cobb 500 male broiler between 35 and 49 days of age. Rocky E. Latham1, Nicki Sriperm2, Rob Shirley3, and Jason T. Lee4.

An experiment was conducted to determine the digestible total sulfur amino acid requirement (dTSAAs) of male Cobb 500 broilers from 35 to 49 d. In increments of 0.065%, dl-methionine (dl-Met) was added to a basal diet that contained 0.90% digestible lysine (dLys). All other essential AA ratios, except dTSAAs, were formulated above their requirements. The dose titration of dl-Met to the diet resulted in 7 dTSAAs levels that ranged from 0.491 to 0.882%; calculated dTSAAs:dLys ratio ranged from 55 to 98. To validate the bioavailability of 2-hydroxy-4-(methylthio) butanoic acid (HMTBa), an additional treatment was formulated to a dTSAAs level of 0.687% with Rhodimet AT88 (88% concentration; 100% bioavailable). Each treatment consisted of 13 rep with 21 birds per pen. Prior to d 35, all broilers were reared on a common starter, grower, and finisher diet. On d 35, all broilers were allotted to achieve statistically equivalent body weights (BW) between pens and blocks in a randomized complete block design. The data were analyzed using PROC MIXED procedure of SAS (2004) included block as a random effect. There was no significant difference in BW among treatments at d 35 (P > 0.05). The evaluated parameters were mortality-corrected feed conversion ratio (FCR), BW, BWG, feed consumption (FC), and cumulative FCR (cFCR). Digestible TAA requirements were determined using a quadratic broken-line model (QB) using ProcNLIN. A one-way ANOVA was conducted to determine if statistical differences were present between the ni-Met and HMTBa treatment. All parameters evaluated showed strong relationships for dTSAAs level, except for FC. The dTSAAs requirements that maximize d49 BW, BWG and minimize FCR and cFCR were 0.793, 0.800, 0.764, and 0.772%, respectively. No differences were observed between the 2 methionine sources confirming that the bioavailability value of Rhodimet AT88 is 100%.

Key Words: TSAA, methionine requirement, broken-line regression

14 Ideally balanced amino acid levels affect laying hen weight and composition, feathering, and amounts of egg components. Dinesh Kumar*, Centaine Raginski, Karen S. Lardner, and Henry L. Classen, University of Saskatchewan, Saskatoon, SK, Canada.

The response of laying hens to balanced dietary protein goes beyond the key production characteristics of egg production, egg weight and feed efficiency. A study was conducted to assess the response of Lohmann LSL hens (27–66 wk of age) to graded levels of digestible lysine (dLys) intake (bracketed values corrected for feed intake) of 550 (560), 625 (651), 700 (707), 775 (795) and 850 (858) mg/hen/day, while other essential AA were balanced relative to dLys level. This report focuses on body weight (BW), tissue weights, feathering quality, and size of egg components as response criteria. A completely randomized design, and Proc Mixed and Proc Reg of SAS 9.3 were used to analyze data. Effects were considered significant when P ≤ 0.05. BW at the beginning of the trial averaged 1.64 kg and was not affected by treatment. At trial end, the average BW for hens consuming 560, 651, 707, 795, and 858 mg dLys/d averaged 1.41, 1.63, 1.71, 1.80, and 1.81 kg, respectively. Absolute and proportional fat pad and breast muscle weights increased with dLys intake, with all responses quadratic except absolute total breast and proportional pectoralis minor weights, where the increase was linear. Ovary weight, number of follicles and size of follicles were not affected by treatment. Overall feathering improved linearly with increasing dLys intake, as it did for 4 of the 5 areas examined (neck, wings, vent, breast); back area feathering improved quadratically with dLys intake. Albumen height (mm) and weight (g) increased linearly with increasing dLys, while increases in egg shell and yolk weight were quadratic. On a proportion basis, egg shell decreased linearly with increasing dLys intake. Yolk and albumen proportional weight responded to dLys in a quadratic manner with highest values found for the 707 and 795, and 858 mg/d treatments, respectively. In conclusion, dLys levels affect hen body weight and composition, feathering and the amounts of egg components.

Key Words: ideal protein, digestible lysine, feather score, body composition

15 Effect of palmitic acid supplementation on hatchability, reproductive performance, and progeny growth. Nirun Boomsinchai*, Justina Caldas, Andrew Magnuson, Judith England, and Craig Coon, University of Arkansas, Fayetteville, AR.

A previous study at the University of Arkansas showed a large amount of palmitic acid was utilized (about 64.0% of palmitic acid content in the fresh yolk) by the embryo from young hens (28 wk of age). Palmitic acid supplementation has been reported to enhance hatchability in Japanese quail (Vilchez et al., 1990). The objectives of the present study were to determine the effect of supplementation of 3.0% of palmitic acid in the diet on hatchability, egg production, and progeny performance of broiler breeder hens. A total of 90 Cobb-500 pullets (18 wk of age) were reared in group floor pens (35 pullets/pen). Pullets were divided into 2 groups, each contained 45 birds. A basal diet was formulated and then corn starch and Palmit 80 (containing 80% palmitic acid) were added to make the control and treatment diets. The experimental period lasts from 18 to 45 wk of age. At 21 wk of age, pullets were placed into individual cage and photo stimulation program was applied. Egg production, hatchability traits, and progeny performance were compared at 27, 35, and 40wk of age. The Student’s t-test was performed to compare performance and Chi-squared test was used for hatchability traits (SAS 4.0). Cumulative egg production at 42 wk of age was not significantly different between
control (77.58 eggs/hen) and palmitic acid supplemented groups (77.16 eggs/hen; \( P = 0.8689 \)). Fertility at 27 wk (80.2 vs. 75.2\%; \( P = 0.0492 \)) and 35 wk of age (89.2 vs. 77.5\%; \( P < 0.05 \)) were significantly higher for breeder hens fed the palmitic acid diet compared with control group. Although, a statistical test was not performed, the hatch of fertile for both ages was numerically higher for hens fed palmitic acid (73.3 vs. 70.0\% and 87.2 vs. 77.0\% at 27 and 35 wk of age, respectively). The body weight (222.01 vs. 228.48 g; \( P = 0.4377 \)), ADG (18.5 vs. 19.6g; \( P = 0.4113 \)), and FCR (1.31 vs. 1.17; \( P = 0.1607 \)) of the progeny from palmitic acid supplemented hens and control group hens at 27 wk were not significantly different.

**Key Words:** palmitic acid, broiler breeder, hatchability, egg production, progeny performance