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## SYMPOSIA AND ORAL SESSIONS

### Metabolism and Nutrition: Nutrition A - Protein/Amino Acids and Feeds

**211 Amino acid requirements in laying hens fed two different energy levels.** M. L. Locatelli\*<sup>1</sup>, A. Lemme<sup>1</sup>, D. Hoehler<sup>1</sup>, P. J. A. Wijtten<sup>2</sup>, J. Van Wichen<sup>2</sup>, J. K. W. M. Sparla<sup>2</sup>, and D. J. Langhout<sup>2</sup>, <sup>1</sup>*Degussa Corp., Kennesaw, Georgia*, <sup>2</sup>*Provimi P.V., Rotterdam, The Netherlands*.

Recent literature data on amino acid (AA) and energy needs and their relationship on performance of modern type laying hens are scarce. The effects of different dietary balanced protein intake levels (550, 600, 650 and 700 mg apparent fecal digestible (AFD) Lys/hen/d) at two different dietary energy intake levels (298 and 313 kcal/hen/d for maintenance (M) and above maintenance (AM)) were determined during peak of production (24-39 weeks of age) in ISA-Brown laying hens. All diets fed the following minimum AFD essential AA ratios to AFD Lys content: Met, 50; Met+Cys, 93; Thr, 66; Trp, 19; Ile, 79 and Val, 86. Six replicates of 12 individually housed hens by treatment were used. Water access was unlimited but feed was restricted to 105 and 112 g/h/d for M and AM energy level intake groups. Restricting the energy intake of laying hens to minimize weight gain, hardly affected egg production parameters but improved feed efficiency ( $P \leq 0.05$ ). Average weight gain of the low-energy-intake groups (M) was 19 g/h over the entire experimental period and was significantly lower than the high-energy-intake groups (AM, 71 g/hen). Increasing the daily AA intake up to 650 mg Lys/hen/d maximized laying %. Hen weight significantly increased between 550 and 650 mg AFD Lys intake, reaching a plateau above 650 mg AFD Lys. This indicates that a daily AFD Lys intake below 650 mg is not sufficient to reach the maximum body protein accretion. Daily egg mass production and feed conversion, however, improved linearly up to the highest AFD Lys level (700 mg). Energy intake level did not affect performance response to daily AA intake. It can be concluded that the balanced protein requirement for maximum daily egg mass production and optimum feed conversion is probably higher than 700 mg AFD Lys/hen/d. Moreover, feed (energy) restriction enables steering of the body weight growth of laying hens during peak of production, and improves feed efficiency.

**Key Words:** laying hens, amino acids, energy

**212 Effects of reducing dietary protein on performance of White Leghorn layers during the second production cycle.** H. M. Yakout\*<sup>1</sup>, D. Hoehler<sup>2</sup>, and C. Novak<sup>1</sup>, <sup>1</sup>*Virginia Tech, Blacksburg*, <sup>2</sup>*Degussa Corporation, Kennesaw, Georgia*.

The use of low protein diets can have potential benefits on reducing nitrogen emissions as well as potential cost savings by reducing high cost protein sources. An experiment was conducted with 384 Hy-Line W-36 hens which were randomly assigned to one of four dietary treatment groups. Corn-soy based diets varying in dietary protein supplemented with commercially available amino acids as follows: [1]

18% CP + Met (\$129.33/ton), [2] 16% CP + Met and Lys (\$126.99/ton), [3] 15% CP + Met, Lys and Thr (\$128.90/ ton), and [4] 13% CP + Met, Lys Thr and Trp (\$138.16/ton) were fed from 38 to 50 wks of age. Cage was considered the experimental unit (4 hens/cage), and each treatment was replicated 24 times.

Overall, hens had similar feed consumption (FI) in diet 1, 2, 3, & 4 of 94.24, 93.79, 93.21 and 93.61 g/h/d, respectively. Egg production (EP) ranged from 83.53 to 72.99% for all dietary treatment with the highest producers fed diet 3 and the lowest for diet 4. Egg weights (EW) performed similarly to EP as they were decreased ( $P \leq 0.01$ ) from 62.23 g. to 57.98 g as dietary protein decreased from 18% to 13%, respectively. Egg mass (EM) was higher ( $P \leq 0.0001$ ) when hens consumed diet 1 (51.74 g), 2 (50.70 g), or 3 (49.65 g) compared to diets 4 (42.69 g). Decreasing dietary protein significantly ( $P \leq 0.007$ ) reduced dry albumen percent, while numerically increased dry shell percentage. Feed consumption (FI), specific gravity (SG), dry yolk, dry shell and yolk solids were not significantly affected by dietary treatments. Dietary treatments 1, 2 and 3 were statistically similar when evaluating production performance and egg components as compared with diet 4. Based on the information gathered in this trial, feeding the 15% CP diet with supplemental Met, Lys and Thr matched the EP and EM of the high protein diet, and in turn should reduce N excretion. The use of such a diet in the field has the potential to save the poultry industry as much as \$0.43 /ton based on the current study. Additional in house or field studies are needed to validate these findings.

**Key Words:** reduced dietary protein, second production cycle, layers

**213 Appropriate statistical methods to compare dose responses of methionine sources.** D. D. Kratzer\*<sup>1</sup> and R. C. Littell<sup>2</sup>, <sup>1</sup>*E-Sci, dba., Olivet, Michigan*, <sup>2</sup>*University of Florida, Gainesville*.

There are two sources of methionine (Met) activity used in commercial feed formulation: DL-2-hydroxy-4-(methylthio) butanoic acid (HMTBA) most commonly available as an 88% solution with 12% water, and DL-methionine, (DLM, 99% powder). Controversy and confusion exists with respect to their relative bioefficacy (RBE). We review the use of a non-linear common plateau asymptotic regression technique (NLCPAR) that has been used to compare the two Met sources with particular emphasis on the validity of the basic assumptions of that model. The controversy is at least in part due to the misapplication of this regression technique to estimate the RBE of HMTBA and DLM. The NLCPAR model is a bioassay with key assumptions that HMTBA is a dilution of DLM, and that each follows dose response curves of the same form and approach a common plateau. Since both provide Met activity it seemed reasonable to accept these assumptions; however, specifically testing them demonstrated that the assumption of a common dose response is not supported by

data. The common plateau assumption was tested by fitting non-linear separate plateaus asymptotic regression (NLSPAR) to a set of 13 published broiler studies in which the NLCPAR model had been used to estimate RBE of HMTBA and DLM. The hypothesis of a common plateau was rejected ( $P < .01$ ), meaning conclusions that HMTBA had lower bioefficacy than DLM based on the NLCPAR methodology were invalid. An example using published data demonstrated the NLSPAR model was a significantly better fit than the NLCPAR and showed that HMTBA and DLM followed different dose responses. Consequently, there was no single value for RBE for the entire dose range; rather the RBE of the two compounds varied with use level. The evidence presented here indicates separate plateau models should be used when comparing these two products. These more valid models can then be used for predictions of differences between HMTBA and DLM at levels of expected use.

**Key Words:** broilers, DL-methionine, 2-hydroxy-4(methylthio)butanoic acid

**214 Improved colostomy technique and excrement collection device for broilers and broiler breeder hens.** M. K. Manangi\*, F. D. Clark, and C. N. Coon, *University of Arkansas, Fayetteville.*

In conducting nutritional experiments using chickens, scientists are limited in determining the urinary excretion of nutrients due to difficulty of separating urine from the feces. Our main objective was to improve the colostomy procedure for urine collection in broilers and both urine and eggs collection for broiler breeder hens. Ketamine HCl, 10-30 mg/kg i.m. in combination with Xylazine, 2-6 mg/kg i.m. was used to anaesthetize broilers (4 weeks old) and broiler breeder hens (25 weeks old). The colostomy technique involved: a) transecting the distal colon at approximately 1½ - 2 cm from the proximal cloaca and ligating distal colonic segment with 3-0 absorbable surgical suture, b) ligating the seromuscular coat of the colon to the peritoneal tissue at three points in a triangular shape using 4-0 silk suture, b) ligating the mesentery at the skin level to prevent continued bleeding of colostomy stoma, and c) placing three sutures using a triangulation technique that consisted of seromuscular aspect of the transected proximal colonic segment and the skin, and d) finally, suturing all exteriorized edges of the transected proximal colonic segment after mucosal eversion to the skin with simple interrupted sutures using absorbable suture. For the purpose of urine and or egg collection the appropriate size of drainable pouch with a curved tail closure was used. The feces were collected on a tray. The colostomized broilers could be kept for several days and colostomized broiler breeder hens were kept for several months to collect urine, eggs (for breeder hens), and feces separately without the problem of cross contamination.

**Key Words:** colostomy, broiler, broiler breeder hens

**215 A critical analysis of methods to determine nutritional requirements.** G. M. Pesti\*, *University of Georgia, Athens.*

Research papers published in *Poultry Science* use a variety of methods for evaluating experiments designed to determine nutritional requirements. Growth trials result in a set of ordered pairs of data. Often, point-by-point comparisons are made between treatments by analysis of variance. This approach ignores that body weight (as well as other response variables) is a continuum. Point-by-point analyses harvests much less than the total amount of information from the

data. Regression models are more effective at gleaning information from data, but the concept of "requirements", is poorly defined by many regression models. Response data from a study of the lysine requirements of young broilers was used to compare methods of determining requirements. In this study multiple range tests were compared to quadratic polynomials (QP), broken line models with linear (BLL) or quadratic (BLQ) ascending portions, the saturation kinetics (SK) and a logistic (LM) and a compartmental (CM) model. The sum of total residuals was used to compare the models. The BLQ and LM were the best fit models (total sum of residuals of 0.1g each), followed by the QP (0.3g), SK (-0.5g), BLL and CM models (0.7g each). A plot of the residuals versus the nutrient intake level showed clearly that the BLQ and SK models fitted the data best in the important region where the ascending portion meets the plateau. While the BLQ model clearly defined the concept of nutritional requirements, the SK, LM and CM models more clearly conceptualize the law of diminishing marginal productivity and economic theory.

**Key Words:** requirements, models

**216 Mean separation procedures used in *Poultry Science*.** J. A. Cason\*<sup>1</sup> and G. M. Pesti<sup>2</sup>, <sup>1</sup>*Russell Research Center, Athens, Georgia,* <sup>2</sup>*University of Georgia, Athens.*

Research papers published in *Poultry Science* were studied to determine the frequency and appropriateness of use of procedures to test for significant differences between treatment means. Excluding papers from symposia, 255 papers and research notes were published in *Poultry Science* in 2004, of which 198 or 77.6% reported differences between means of 3 or more treatments. Mean separation was accomplished with the following procedures: Duncan's multiple range test, 46 papers; least significant difference, 32; Tukey's, 25; t test, 24; contrasts, 21; least squares, 21; paired t test, 12; and other, 20. Eleven papers showed separation of means in tables or figures but did not specify a method. Use of more than one procedure in a single paper resulted in a total of 201 procedures used in 187 papers that specified methods. Some methods were not used appropriately. Examples of inappropriate use of Duncan's multiple range test, for example, included use with factorial designs (8 instances), application to designs with graded levels of treatments where regression techniques could have been used (3), use in experiments designed with internal structure such that treatments could have been analyzed with orthogonal contrasts (6), and in cases where the only comparisons discussed were between individual treatments and a control (4). Despite numerous papers and textbooks that discuss the proper use of mean separation procedures, many papers in *Poultry Science* report results that were not analyzed by methods most likely to find significant and meaningful differences in the data under study.

**Key Words:** multiple range tests, mean separation, statistical analysis

**217 Effect of different levels of protein and sulfur amino acids on mature broiler breeder hens performance, carcass and reproductive morphology.** A. Pishnamazi\*<sup>1</sup>, J. Purreza<sup>1</sup>, and F. E. Robinson<sup>2</sup>, <sup>1</sup>*Isfahan University of Technology, Isfaha, Isfahan, Iran,* <sup>2</sup>*University of Alberta, Edmonton, AB, Canada.*

An experiment was conducted to investigate the use of supplemental sulfur amino acids and reduce protein level in diets for broiler breeder hens. Eight hundred Hubbard Classic females (27WK) were

individually weighed. Eight hens with one male were transferred to breeding pens. Hens were randomly sorted into 25 treatment groups. Treatments involved feeding different levels of CP (17.5, 16.0, 14.5, 13.0 and 11.5%) and sulfur amino acids (0.69, 0.66, 0.63, 0.60 and 0.57%). Hens were weighed weekly. Egg production, egg weight and settable eggs were recorded every day. Fertility was determined by candling at 7 days incubator. Hatchability was estimated on 21st day of incubation. All chicks were weighed at hatch. At the end of the trial (50WK) 2 hens per pen were dissected. Birds fed 14.5% CP had the highest egg production. Settable eggs from birds fed 11.5 and 16.0% CP were higher than other groups ( $p > 0.05$ ). Birds fed 11.5% CP had lower BW than other groups. Eggs from birds fed 11.5 and 13.0% CP, and 0.57 and 0.60% sulfur amino acids were significantly smaller than other treatments and resulted in reduced chick weight at hatching. CP and sulfur amino acid level had no effect on fertility and hatchability, however the number of chicks produced by birds fed 16% CP and 0.57% sulfur amino acids were higher than for other groups ( $p > 0.05$ ). The lowest liver weight and highest fat pad weight was seen in hens fed 17.5% CP. Birds fed 0.69% sulfur amino acids had lowest fat pad. Birds fed high levels of sulfur amino acids had heavier Pectoralis minor weights. Birds fed higher levels of CP had heavier oviducts; mainly because they were heavier in BW (no proportionate differences). The numbers of large yellow follicle were higher for birds fed higher levels for acids intake. These data suggest that 20.3 (11.5%) g/b/d CP intake and 832 (0.57%) mg/b/d sulfur amino acids intake is adequate for mature broiler breeder hens.

**Key Words:** broiler breeder, protein, sulfur amino acid

**218 Maintenance nitrogen requirement of adult female ostriches (*Struthio camelus*).** D. C. Bennett\*, A. Kaneko, and Y. Karasawa, *Shinshu University, Minamiminowa-mura, Nagano-ken, Japan.*

Successful ostrich farming requires knowledge of the nutritional needs of the birds. While much information is available on the nutritional value of various feed ingredients fed to ostriches, there is little known about their specific nutrient requirements. In this study, we measured the maintenance nitrogen requirements (MNR) of ostriches by nitrogen balance. We predicted, based on allometric analysis of nitrogen requirements of various species of birds, that ostriches would have a MNR of 20.9 g N/d and an endogenous nitrogen loss (ENL) of 3.9 g N/d. Three adult female ostriches fed five pelleted diets containing 0.6 to 2.3 % N (4-15 % CP), 18 kJ/g gross energy (11.4 kJ/g ME) and 15 % crude fiber. Ostriches were fed each diet in random order, and each dietary trial consisted of a 10-day adaptation period, followed by a 5-day total excreta collection period. Body mass ( $108 \pm 2.4$  kg) and metabolizable energy intake ( $19.9 \pm 0.4$  MJ/d) were unaffected by dietary nitrogen levels. Similarly, nitrogen balance was unrelated to metabolizable energy intake. After correcting for excreta nitrogen losses during drying, MNR was calculated to be 16 g N/d (100 g CP/d) and ENL as 9.9 g N/g. Failure to correct for the  $10.9 \pm 4.1$  % N losses during drying would under predict the "true" MNR by 37% and ENL by 48%. Our estimate for MNR of ostriches predicts a dietary requirement of 5.8% protein. Our estimate of ENL was 2.5 times that predicted, possibly reflecting the high fiber content of their diet.

**Key Words:** ostrich, protein requirement, nitrogen requirement

**219 The amino acid requirements for production and fertility of broiler breeder hens at peak production.** M. de Beer\* and C. N. Coon, *University of Arkansas, Fayetteville.*

A total of 640, 30-week old Cobb-Vantress broiler breeders with similar body weight ( $3450 \pm 218$ g) were selected to determine the production requirement of dietary digestible arginine, cystine, isoleucine, lysine, methionine, threonine, tryptophan, and valine in a 70 day feeding study. The average hen day egg productions for the start of the trial and for the 10 week period were 82% and 63%, respectively. Breeders were given a corn-soy basal diet plus crystalline amino acids with eight graded levels of arginine, cystine, isoleucine, lysine, methionine, threonine, tryptophan, and valine representing 40% to 120% of the highest suggested requirement between NRC (1994) and Fisher (1998). All other amino acids were maintained at 100% of their suggested requirement level. Diets were supplemented with glutamic acid to fulfill the total crude protein requirement. The breeders were fed 154 g of feed (467 kcal ME) daily. Each level of each amino acid was represented by ten birds. All breeders were inseminated weekly with  $5 \times 10^7$  sperm cells. Every egg was recorded, weighed and set for fertility determinations. The total egg mass output added to total wt gain/loss was defined as product. The feed consumption divided by the product was defined as feed/product ratio. The digestible arginine, cystine, isoleucine, lysine, methionine, threonine, tryptophan, and valine requirements for product and feed/product ratio were determined to be 1002.25 mg/d and 1007.76 mg/d, 463.13 mg/d and 465.12 mg/d, 828.12 mg/d and 806.14 mg/d, 855.95 mg/d and 829.64 mg/d, 454.20 mg/d and 427.50 mg/d, 629.38 mg/d and 612.75 mg/d, 245.81 mg/d and 237.80 mg/d, 783.28 mg/d and 782.13 mg/d, respectively. A significant decrease in fertility was noted with increasing levels of isoleucine and lysine.

**Key Words:** amino acid requirements, peak performance, fertility

**220 Effect of sunn hemp seed inclusion in broiler starter diets on live performance attributes.** J. B. Hess\*<sup>1</sup>, V. A. Drouet<sup>1</sup>, and J. A. Mosjidis<sup>2</sup>, <sup>1</sup>Auburn University, Auburn, Alabama, <sup>2</sup>Auburn University, Auburn, Alabama.

Seeds of *Crotalaria* spp. Contain pyrrolizidine alkaloids that are toxic to a range of animal species. Sunn hemp (*C. juncea* L.), a relative of showy crotalaria (*C. spectabilis* Roth.) known to be toxic to chickens, has only a small amount of those toxins. This trial examined live performance responses of mixed-sex broilers raised to 21 days of age on one of three treatments to determine whether sunn hemp seeds of a breeding population containing 2.5% of the pyrrolizidine alkaloids present in showy crotalaria were detrimental to young broilers. The birds were housed in Petersime battery brooders with eight replicates per treatment (a total of 240 birds). A mash starter feed was fed to 21 days with or without whole sunn hemp seed. Treatments included a control, a contamination level (0.5% sunn hemp seed) and an ingredient inclusion level (5% sunn hemp seed). Body weights, feed consumption and feed conversion were measured by pen at 21 days. Mortality was monitored and was posted to determine cause. Broilers did not consume sunn hemp seeds at the same rate as the rest of the diet. For this reason, sunn hemp consumption was not accomplished at the exact levels stated. Body weights were reduced in birds fed 5% sunn hemp (801.3 vs 849.9 g), but not in birds fed 0.5% (858.0 vs 849.9 g) as compared to the control. Period gains showed a similar pattern. Feed consumption was reduced in birds fed 5% sunn hemp (1.072 vs 1.123 kg/bird), while feed conversion ratio was poorer (1.374 vs 1.322). No

significant mortality differences were measured between treatments and no unusual pathologies were noted in the birds during posting.

**Key Words:** sunn hemp, *Crotalaria*, broiler

**221 Determination of the metabolisable energy of sweet potato tuber meal and its utilization by growing pullets.** O. Ladokun<sup>\*1</sup>, F. Aderemi<sup>2</sup>, and O. Tewe<sup>3</sup>, <sup>1</sup>Lead City University, Ibadan, Oyo State, Nigeria, <sup>2</sup>Bowen University, Iwo, Osun State, Nigeria, <sup>3</sup>University Of Ibadan, Ibadan, Oyo State, Nigeria.

The nutritive value of sweet potato tuber meal (SPM) as replacement for maize in the diet of growing pullets was evaluated. The trials were conducted using the completely randomized experimental design. A preliminary 10 day study was conducted with thirty pullet chicks to determine the metabolisable energy (ME) of SPM. The result revealed that SPM has an ME of 3.50kcal/g. In the feeding trial which lasted 49 days, SPM was used to replace maize at 0, 50 and 100% levels. A total of ninety day-old Yaffa pullet chicks with an average initial weight of 55.51g were used for the study. Digestibility of dry matter for chicks on the control diet was significantly ( $P<0.05$ ) higher than for chicks on the sweet potato based diets. Chicks fed maize-based (control) and the partially replaced maize diet had weights, which were significantly ( $P<0.05$ ) higher than those on the completely replaced maize diet. Pullet chicks fed the control diet consumed significantly ( $P<0.05$ ) higher feed than the birds on the sweet potato based diets. The economy of production of pullet chicks revealed that partially replaced maize diet appeared to be more economically efficient, thereby justifying the replacement.

**Key Words:** metabolisable energy, sweet potato, pullet chicks

**222 Dietary energy needs of broilers from 2.0 to 4.0 kg as influenced by ambient temperature.** W. A. Dozier<sup>\*1</sup>, J. L. Purswell<sup>1</sup>, A. Corzo<sup>2</sup>, M. T. Kidd<sup>2</sup>, and S. L. Branton<sup>1</sup>, <sup>1</sup>USDA-ARS Poultry Research Unit, Mississippi State, Mississippi, <sup>2</sup>Mississippi State University, Mississippi State.

Two trials were conducted to evaluate potential interactive effects of dietary AME x ambient temperature from 36 to 60 d of age on growth and meat yield responses of broiler chickens. Nineteen-hundred and twenty Ross x UY Hubbard broilers were randomly distributed to 32 floor pens (30 males and 30 females; 0.09 birds/m<sup>2</sup>) at 36 d of age. Treatment structure was a 4 x 2 factorial arrangement. The main effect of AME (16 replicate pens; 8 replicate pens/trial) was diets formulated to 3,175, 3,220, 3,265, and 3,310 kcal/kg. Temperature effect (2 replicate rooms; 1 replicate room/trial) consisted of two regimens. Regimen 1 was set at 21.1° C from 36 to 38 d, 20.2° C from 39 to 42 d, 18.9° C from 43 to 46 d, 17.8° C from 47 to 50 d, 15.6° C from 51 to 54 d, and 12.8° C from 55 to 60 d. Regimen 2 was set at 21.1° C from 36 to 60 d of age. From 36 to 60 d, gradient increases of dietary AME decreased ( $P\leq 0.001$ ) feed consumption and improved ( $P\leq 0.001$ ) feed conversion linearly. Reducing ambient temperature improved ( $P\leq 0.10$ ) BW (4.07 vs. 3.82 kg), feed consumption, feed conversion, and reduced ( $P\leq 0.02$ ) mortality. Dietary AME x temperature interactions ( $P\leq 0.02$ ) were observed for BW, BW gain, feed consumption, and feed conversion. BW and BW gain increased with increments of dietary AME when subjected to Regimen 2 but not with Regimen 1. With increasing dietary AME, the slope for feed conversion was more pronounced with Regimen 2 than Regimen 1 (-0.07 vs. -0.04). This

indicates that for each 45 kcal/kg increase in AME that feed conversion would be improved by 7 points with Regimen 2, and 4 points with Regimen 1. Treatments did not affect the absolute and relative amounts of abdominal fat and total breast meat. Results indicate that these broilers had a higher dietary AME need when subjected to increased temperature. Decreasing ambient temperature below than currently being used in commercial practice from 51 to 60 d led to improved growth performance.

**Key Words:** broiler, dietary energy, temperature

**223 The effect of different levels of virginiamycin and energy on performance and blood components in broiler chicks.** F. Ahmadi<sup>\*</sup>, Azad University of Sanandaj, Sanandaj, Kurdistan, Iran.

This experiment was carried out to study the effect of different levels (2800,2900Kcal/Kgdiet) of energy and virginiamycin (0,10,20,30mg/kgdiet) on performance and component of blood serum of broiler chicks. In completely randomized design and in 2\*4 factorial arrangement, four hundred and eighty (480) broiler chicks (Ross) were divided into 24 groups, 20 chicks per group. Feed consumption, bodyweight and mortality of each and in 2\*4 factorial arrangement, four hundred and eighty (480) broiler chicks (Ross) were divided into 24 groups, 20 chicks per group. Feed consumption, bodyweight and mortality of each pen were determined at 21, 42 and 56 days of experimental period. At the end of experimental period from each pen one male and female were selected, slaughtered and blood samples were collected at slaughtering time. After separation of serum, calcium, phosphorous, magnesium and triglyceride were measured by using the relevant methods Also percentage of small intestine, abdominal fat, liver and etc, were measured. The results indicated that different levels of energy had not significant effect on bodyweight, feed conversion ratio and blood serum components, but its effect on feed consumption at the 21st day of age was significant ( $p<0.05$ ). Virginiamycin had not significant effect on the average feed consumption and blood serum components, although these criteria had increasing trend with increasing the levels of virginiamycin. Virginiamycin had significant (0-21days)effect on average bodyweight and feed conversion ratio( $p<0.05$ ).Interaction between energy and virginiamycin (body weight from 0 to 21 and 21 to 42 days)were significant ( $p<0.05$ ).Interaction between virginiamycin and different levels of energy had not significant effect on abdominal fat percentage, liver percentage, and blood serum components. Interaction between virginiamycin and sex on intestine percentage was significant( $p<0.05$ ).Interaction between virginiamycin, energy and sex had not significant effect on plasma components including calcium, phosphorous, magnesium and triglyceride.

**Key Words:** viginiamycin, bloodserum, broiler

**224 True metabolizable energy in meat and bone meal from Iran.** H. Janmohammadi<sup>\*1</sup>, H. Nassiri Moghaddam<sup>2</sup>, J. Pourreza<sup>3</sup>, M. Danesh Mesgran<sup>2</sup>, and A. Golian<sup>4</sup>, <sup>1</sup>University of Tabriz, Tabriz, East Azarjan, Iran, <sup>2</sup>University of Ferdowsi, Mashhad, Iran, <sup>3</sup>Esfan University of Technology, Esfahan, Iran, <sup>4</sup>University of Manitoba, Winnipeg, MB, Canada.

Meat and bone meal (MBM) is an ingredient of farm animal diets, particularly in poultry and Pig. Evaluation of available energy in meat and bone meal, like other ingredients, is necessary for diet formulation.

Metabolizable energy of MBM depends on raw material source and processing condition, is variable. In Iran, MBM are produced from slaughter wastes of beef, lamb, goat and or camel. The product is used mostly in poultry diets but there are not any data of its true metabolizable energy (TMEn) content. The objective of present study was to determine TMEn in MBM samples from Iran. Six composed samples were taken randomly from a large rendering plant in east of Iran and kept at -20 C until chemical analysis. Gross energy (GE) by Parr adiabatic calorimeter bomb and DM and CP (6.25 \*N) were determined according to AOAC (1990) methods. True metabolizable energy (TME) in the samples was determined by Sibblald's precision fed assay, using thirty five intact leghorn roosters (1989). Endogenous

energy loss (EEL) was measured in one group of five roosters which fasted 48 hours. The obtained data were subjected to one way analysis by GLM procedures of SAS (2002). Comparison of means was done by Duncan test. Mean EEL and EEL corrected to zero nitrogen balance were 14.6 and 7 kcal/48 h. True dry matter digestibility, gross energy efficient (TMEn/GE), TME and TMEn values were significantly different among sample (0.05). Mean (and range) of TME and TMEn were 3183(2692 to 3884) and 2993(2473 to 3253) kcal/kg respectively. The results showed that available energy content of MBM from Iran's animal rendering plants is high, but like the results of other reports, TMEn values is relatively variable.

**Key Words:** TMEn, meat and bone meal

## Metabolism and Nutrition: Nutrition B - Enzymes & Manufacturing

**225 Variability in feed value of Australian wheat-, triticale- and sorghum-based diets supplemented with and without enzymes for broilers.** T. A. Scott\*, *University of Sydney, Camden, NSW, Australia.*

Our definition of feed value now includes measurements of variation in nutrient intake that have been directly correlated with growth. Within cereal grains, variation in intake can be in excess of 20% and is not related to energy or protein levels of the diets. In the present study, 45 grains (34 wheat, 8 triticale and 3 sorghum) were ground and included (750 g/kg) in mash diets (wheat and triticale diets had a different basal diet from sorghum-based diets); all diets contained 1% acid insoluble ash marker. The diets were then split and one portion supplemented with 0.5 g/kg xylanase and phytase (Danisco Animal Nutrition, UK). The 90 diets (45 cereal-based diets with or without enzyme) were each full fed to one cage of six male broilers (Cobb 500) in four consecutive bioassays from 4 to 17 d of age. At 16 d a 6 h excreta collection was frozen, freeze-dried, ground and analysed to determine the AME (kcal/kg diet). Feed intake, growth and mortality were recorded from 4 to 17 d and used to calculate feed conversion ratios. Fifteen of the 34 wheat samples had been previously tested in another bioassay; diets contained no enzyme(s) and birds were five-weeks of age; AME was determined by total collection. The present study supports earlier work that demonstrated measurements of feed value must not ignore the variation in intake, growth and efficiency. Variation in feed intake of wheat-based diets (~20%) was positively correlated ( $r > 0.70$ ) with body weight; while correlations between intake and AME were positive ( $r = 0.30$ ). Variation in performance of triticale samples was similar to wheat, while no enzyme response was observed for sorghum-based diets due to low levels of soluble non starch polysaccharides. The 15 wheat samples measured in two different bioassays had significant positive correlations for measures of performance, but no relationship for measures of AME. This indicates that factors within these common grains consistently influenced performance in a similar manner, but not AME. Further work is required to understand the cause of variation or limitation in intake and how this can be minimized.

**Key Words:** AME, cereals, feed intake

**226 Should oligosaccharides be considered as antinutritive factors and target substrates for enzyme use in broiler chicken diets?** B. A. Slominski\*<sup>1</sup>, X. Meng<sup>1</sup>, L. D. Campbell<sup>1</sup>, W. Guenter<sup>1</sup>, and O. Jones<sup>2</sup>, <sup>1</sup>*University of Manitoba, Winnipeg, MB, Canada,* <sup>2</sup>*Canadian Bio-Systems Inc., Calgary, AB, Canada.*

Removal of oligosaccharides has been indicated to be beneficial for poultry as an increase by 20% in the TME of SBM was noted following ethanol extraction. Interpretation of the data, however, is confounded by the fact that ethanol extraction would result in the removal of many other components of the meal. Specific removal of oligosaccharides by using  $\alpha$ -galactosidase enzyme has been investigated in our laboratory. In many studies, very low digestibility of oligosaccharides in enzyme supplemented diets was observed. Factors capable of causing enzyme inactivation were evaluated and the low pH in the upper gut was considered to be the most significant. Recently, a new preparation of  $\alpha$ -galactosidase has been evaluated for its ability to improve the rate of oligosaccharide hydrolysis. Incubation of 5g of SBM with enzyme for 90 min at 40°C resulted in a significant reduction in oligosaccharide content (from 68.8 to 42.4 mg/g) at an enzyme to substrate ratio of 1:175 and almost complete oligosaccharide hydrolysis (from 68.8 to 4.5 mg/g) at an enzyme to substrate ratio of 1:35. In studies with broiler chickens (5-18 d) using wheat/SBM/canola meal diets, the total tract digestibility of oligosaccharides averaged 27.2% for a control diet, and 32.1 and 57.4%, respectively, for 0.01% (1:175 enzyme to substrate ratio) and 0.05% (1:35 enzyme to substrate ratio)  $\alpha$ -galactosidase supplemented diets. Despite the fact that the hydrolysis of oligosaccharides was substantial at the 0.05% enzyme level, it was not reflected in any improvement in growth performance with weight gain and feed conversion values of 439.7 g/14 days and 1.53 being identical to those of 447.4 and 1.52 for the control diet, respectively. It would appear evident that the oligosaccharides raffinose and stachyose do not pose a nutritional concern and that the use of  $\alpha$ -galactosidase enzyme to enhance their digestibility may not be beneficial.

**Key Words:** oligosaccharides,  $\alpha$ -galactosidase, broilers