

151 Live performance and meat yield responses of straight-run broilers to progressive concentrations of dietary energy maintained at a constant ME:Protein ratio. M. A. Hidalgo*, W. A. Dozier, III, A. J. Davis, and M. E. Freeman, *University of Georgia.*

According to a popular benchmark reporting service, a diverse array of metabolizable energy values is being used in formulating diets for broiler chickens. Reducing dietary energy concentration while maintaining a constant ME:Protein ratio has been shown to result in equivalent broiler performance as compared to utilizing high energy diets when broilers are marketed at 6.5 lb. This study examined the effects of progressive concentrations of dietary energy at a constant ME:Protein ratio on live performance and processing yields of broilers during a 37-d production period. A total of 2,592 Ross x Ross 308 straight-run broilers were sexed and 27 of each sex were commingled and randomly assigned to one of 48 floor pens. Birds were given a three-phase feeding program, which consisted of starter (0-17 d), grower (18-30 d), and finisher (31-37 d). Dietary treatments consisted of six feeding regimens (8 reps/trt): Regimen 1: starter - 1,350 kcal/lb, grower - 1,370 kcal/lb, and finisher - 1,400 kcal/lb; Regimen 2: starter - 1,370 kcal/lb, grower - 1,390 kcal/lb, and finisher - 1,420 kcal/lb; Regimen 3: starter - 1,390 kcal/lb, grower - 1,410 kcal/lb, and finisher - 1,440 kcal/lb; Regimen 4: starter - 1,410 kcal/lb, grower - 1,430 kcal/lb, and finisher - 1,460 kcal/lb; Regimen 5: starter - 1,430 kcal/lb, grower - 1,450 kcal/lb, and finisher - 1,480 kcal/lb; Regimen 6: starter - 1,450 kcal/lb, grower - 1,470 kcal/lb, and finisher - 1,500 kcal/lb. In general, body weight measurements were lower ($P < 0.05$) when broilers consumed Regimen 1 compared with the other regimens throughout each phase of growth. Feed conversion ratio was improved ($P < 0.05$) with Regimens 4, 5, and 6 compared with Regimen 1 from 18-30 d, 30-37 d, and 0-37 d as was feed consumption ($P < 0.05$) from 30-37 d and 0-37 d. Dietary treatments did not alter the incidence of mortality, abdominal fat percentage, chilled carcass yield, or the recovery of carcass parts. These data indicate reducing metabolizable energy content of the diet at a constant ME:Protein ratio allows similar live performance to be obtained without affecting meat recovery, but decreasing the energy content of the diets to sub-optimum concentrations adversely affected performance, which may be related to inadequate caloric and protein consumption.

Key Words: Broilers, Dietary energy, Meat yield

152 Use of single diet feeding programs for broilers. D. O. Skinner-Noble¹, F. Abraham*¹, J. G. Berry¹, and R. G. Teeter¹, ¹*Department of Animal Science, Oklahoma State University.*

Two trials were conducted to evaluate the usefulness of simplified feeding programs for broilers, both for simplicity and for their potential use as a simple management method to reduce early growth and its associated negative consequences. Trial 1 fed either a classical three-phase feeding program or the grower diet throughout to broiler females. Trial 2 fed the three-phase feeding program, the grower diet throughout, or the starter diet throughout to both male and female broilers. Broiler performance traits (BW, feed intake, feed conversion), carcass traits, income and feed expenses, and feed nutrient substrate and carcass deposition were recorded in both trials. In both trials, feeding the grower diet

throughout reduced early growth. Even though compensatory gain was exhibited, birds fed the grower diet throughout were not able to recover from this growth restriction by market age. Overall feed conversion was poorer for birds fed the grower diet throughout in both trials. Whereas feeding program affected feed costs, income was similarly affected by changes in BW, resulting in similar income less feed costs. Feeding program affected nutrient substrate intake. Similar carcass energy per kg of diet was observed for all feeding programs in both trials. Feeding the classical three-phase feeding program resulted in reduced percent protein intake, with greater final BW than the grower diet feeding program. Feeding the grower diet throughout increased carcass fat and decreased carcass protein, whereas feeding the starter diet throughout increased carcass protein and decreased carcass fat. The results of the current study indicate that feeding a grower diet throughout is not a practical method of growth restriction for broilers and that current phase feeding still is merited for broilers.

Key Words: Protein, Energy, Feeding program

153 Utilization of low crude protein diets fed to 0-3 wk broilers. S. E. Brooks*¹, H. M. Allen¹, and J. D. Firman¹, ¹*University of Missouri-Columbia.*

Commercial broilers were fed an industry type diet meeting the 1994 NRC requirements for the first week post-hatch. The diet was formulated to contain 23% CP and 3200 kcal of ME/kg. At day 7, birds were individually weighed, sorted by weight, and randomly assigned to pens, placing four birds per pen. Birds were housed in chick batteries while on study in a randomized complete block design. There were 9 treatments with 8 replications per treatment for a total of 72 pens. The 23% CP diet fed for the first week post-hatch served as the positive control. Treatments were titrated with respect to intact CP as follows: 20%, 19%, 18%, 17%, 16%, 15%, 14%, and 13%. Crystalline amino acids were added back to the diets to meet the amino acid levels found in the 23% CP diet. Glutamic acid was supplemented to bring all of the diets up to 20% protein equivalent. All diets were formulated on a digestible basis to be isocaloric and isonitrogenous. Birds were fed and watered *ad libitum* for the duration of the study. At the conclusion of the study, birds were euthanized and weighed. There were found to be no significant differences ($P \leq 0.05$) in average bird gain for all treatments ranging from the 23% CP treatment to the 15% CP treatment. It appears that while there was not a significant difference in bird gain with respect to the 14% CP treatment when compared to others, growth was beginning to decline. Differences in average bird gain were found to be significant for the 13% CP treatment. Feed:gain and feed consumption revealed no significant differences among treatments. The results of this study indicate that feeding a 15% CP diet and crystalline amino acid supplementation can achieve similar growth and performance as that of a 23% CP diet. This marked reduction in crude protein will not only provide an effective cost saving to producers but also aids in the reduction of excess nitrogen pollution to the environment.

Key Words: Broiler, Low protein

Nutrition - Nutrition B

154 Response of small broilers to feeds varying in nutrient density or the presence of a prestarter feed. J. B. Hess*¹, S. F. Bilgili¹, R. W. Gordon², T. J. Frost², and E. R. Miller³, ¹*Auburn University, Auburn, AL*, ²*Gold Kist Inc., Atlanta, GA*, ³*Aviagen N.A., Albertville, AL.*

This trial examined the feeding of three amino acid densities and a prestarter program to mixed-sex broilers to 34d of age. The control program (C) was similar to feeds used commercially, with lysine densities of 113, 109 and 111% of NRC for the three feed program. TSAA densities were 109, 125 and 125 % of NRC. Additional trt had protein/amino acid densities of 107% (M) or 115% (H) through all three feeds. A prestarter was fed (1/2 lb./bird) in trt PS, with the C starter fed for the remainder of the 19d starter period. Control grower and withdrawal were fed to trt C and PS from 19d to 34d. Ross 308 cross broilers were placed at 0.70 sqft./bird with equal numbers of each sex per pen. There were 8 replicates per trt. At termination, 5 males and 5 females were processed

for carcass yield determination at both Auburn University and at Aviagen's facilities in Albertville, AL. BW were altered at 19 and 34d, with H (highest plain of protein/amino acid nutrition) showing significantly better weights. At 19d, Trt M and PS were intermediate, although this affect was lost by 30 and 34d. BW were higher than desired due to excellent growing weather between 30 and 34d (4.21 lb). Mortality was low, with no significant differences noted in cumulative mortality among trt. Adjusted FCR was not different between trt at 19 or 34d, although FCR trended lower with increasing AA density. Adjusted FCR was significantly lower for H at 34d. No differences were noted in interim FCR numbers. BW of birds selected for processing showed trends similar to that seen in the live portion of the trial. Lean carcass and chilled WOG yields followed body weight trends, with H showing the best yields. Birds fed a prestarter (PS) showed intermediate yields in the Auburn results and highest yields in the Albertville results. Fat yield was lowest in the highest density treatments, with no advantage to a prestarter. Front half weight was highest in birds from H, with PS intermediate. Increased nu-

trient density generally improved small bird performance. Although a prestarter feed did not show live performance benefits through the end of the study, yield data were favorable.

Key Words: Diet density, Broiler, Carcass yield

155 Response of small broilers to feeds varying in nutrient density. J. B. Hess*¹, S. F. Bilgili¹, R. W. Gordon², and T. J. Frost², ¹Auburn University, Auburn, AL, ²Gold Kist, Atlanta, GA.

A large portion of broilers raised in the U.S. are taken to higher weights for deboning. Companies raising small broilers (3.9 to 4.25 lbs) have less research data on which to base their program decisions. This study compared two diet density programs fed to Ross 308 broilers to 35 days of age. The control program (C) was similar to feeds used commercially, with lysine densities of 113, 109 and 111% of NRC for the three-feed program. TSAA densities were 109, 125 and 125 % of NRC. The higher density program (H) was designed to have protein and amino acid densities that were 107% of C. Starter was fed to 19d, with grower fed to 30d and withdrawal fed to 35d. Equal numbers of each sex were placed in 8 pens/trt at 0.70 sq.ft. bird (166 birds/pen). At termination, 10 males and 10 females per pen were processed for carcass yield determination. Growth was excellent and final weights were larger than anticipated. H improved BW at 19, 30 and 35 days (4.25 lb vs. 4.42 lb at 35d). Interim BW were not different significantly, although BW for the 19-30d period was numerically higher for H. Feed conversions were not different between trt. Mortality was low across trt (2.1%) and did not differ by trt. Preslaughter BW differed at the 1% level of significance (1932g for C vs. 2015g for H). Lean (1298g vs. 1368g) and chilled carcass (1330g vs. 1398g) weights were increased by H, although chilled WOG yields did not differ (69.0% vs. 69.4%). Front half (726g vs. 771g) and leg quarter (569 vs. 597) weights were similarly increased by H, while yields were not altered significantly (37.8% vs. 38.3% for front half). Trt by sex interactions indicated that males showed more response to higher nutrient density than females.

Key Words: Diet density, Broiler, Carcass yield

156 Reduced amino acid density feeding programs impact variability and performance of broilers. M. T. Kidd*¹, C. D. McDaniel¹, S. J. Barber¹, E. R. Miller², B. I. Fancher², and B. B. Boren², ¹Mississippi State University, Mississippi State, MS, ²Aviagen, Huntsville, AL.

Increasing dietary amino acid density typically improves broiler growth and carcass attributes, but subsequent effects on BW variability have been studied little. Floor pen experiments were conducted with Arbor Acre Plus broilers to evaluate the impact of feeding program and amino acid density on broiler growth and carcass traits (Experiment 1) and BW variability (Experiment 2). In Experiment 1, high (H), medium (M), and Low (L) dietary amino acids levels were fed (0 to 14 d, 15 to 28 d, 29 to 35 d, and 36 to 49 d of age) to derive eight dietary treatments. Respective treatments for the four time periods consisted of: 1) HHHH, 2) HHML, 3) HHLL, 4) HMML, 5) HMLL, 6) HLLL, 7) MMMM, and 8) LLLL. In Experiment 2, treatments 1, 7, and 8 were fed throughout the former periods. Gender was a main effect in both experiments resulting in factorial designs (2 x 8 with 6 replications in Experiment 1; 2 x 3 with 8 replications in Experiment 2). Treatment by gender interactions ($P < 0.05$) did not occur. Male broilers had higher ($P < 0.05$) BW gains than female broilers. Except birds fed MMMM treatment, birds fed the H treatment in the first feed and H or M treatments in the second feed had the highest ($P < 0.05$) Day 49 BW gain. At Day 35, birds fed HHH had more ($P < 0.05$) breast meat yield (17.0%) than birds fed MMM (16.2%) or LLL (15.6%). At Day 49, birds fed HHHH, MMMM, or HHLL (average breast yield of 18.7%) had higher breast meat yield ($P < 0.05$) than birds fed HLLL (17.8%) or LLLL (16.5%). Birds fed the LLLL dietary regime in Experiment 2 had a higher ($P < 0.05$) coefficient of variation for BW than birds fed the MMMM or HHHH dietary regime. Reducing amino acid density in the final feeds resulted in good growth and carcass traits provided that high amino acid levels were fed in the first two feeds. Moreover, moderate to high amino acid levels reduced variability of birds at processing.

Key Words: Broiler, Amino acid density, Feeding program

157 Broiler utilization of vegetarian diets. S. L. Vieira*¹, I. L. Lima², C.A.Q. Borges², L. M. Fernandes¹, and V. R. Quadros¹, ¹Universidade Federal do Rio Grande do Sul, ²Perdigão Agroindustrial S/A - Brazil.

Some recent changes in the international meat market have caused major changes in the way broiler meat is produced around the world. The European Community and some Arab countries have approved new legislation restricting their imports only to broiler meat produced from birds grown exclusively with feeds having vegetarian ingredients. A study was conducted with the objective of evaluating live performance, water intake, excreta moisture, and digestibility of vegetarian diets when compared with usual diets, which include by-products of animal origin. Twenty one day-old broiler chickens were placed in steel battery cages, 1 m² each, and given vegetarian diets formulated with corn, soybean meal and soy oil or usual diets prepared with those ingredients but also including 3.0% pork by-product meal, 2.5% poultry by-product meal, and 1.5% feather meal. The two diets were formulated with a similar nutrient profile, including true digestible amino acids, and were given from 21 to 35 d of age (20% CP, 3,200 kcal ME/kg, 0.85% Met+Cys, 1.10% Lys, 0.90% Ca, 0.42% Av.P). Vegetarian diets had 0.83% K, whereas the usual diets had 0.68. The two dietary treatments had 20 replicates of 6 Ross X Ross 308 male birds each averaging 858 g at the beginning. Birds on vegetarian diets consumed 13% more water (3,334 vs. 3,763 ml/bird) and produced an amount of excreta 18% greater (1,841 vs. 2,171 g/bird). Excreta from birds fed the vegetarian diets also had a greater proportion of moisture (79.9 vs. 81.4%) than that from birds fed the usual diets in the two-week period. Digestibility of vegetarian diets was 3.4% lower than that from the usual diets. Differences in weight gain, feed conversion and mortality between the two types of diets were not detected. Higher concentrations of potassium and fiber in the vegetarian diets are likely to cause the observed responses in broiler digestion. Live performance, however, is not greatly affected as long as feed formulation accounts for ingredient differences.

Key Words: Broiler, Vegetarian diets, Digestibility

158 Metabolizable energy of soybean meal. N. M. Dale* and A. B. Batal, University of Georgia.

While soybean meal (SBM) is primarily considered to be a protein source for poultry, its high level of inclusion in many feeds results in the ingredient providing between 20-25% of the metabolizable energy. The wide variation in the protein content of SBM is inversely related to the fiber content, depending largely upon whether hulls have been added back to the meal. It is recognized that low protein, high fiber meals have lower metabolizable energy than high protein, dehulled SBM. However, this relationship has not been adequately studied.

Twenty-three samples of solvent-extracted soybean meal were obtained from commercial sources and evaluated for proximate composition and metabolizable energy, using the TME_n assay. Following a 30 hr adjustment period, 10 Single Comb White Leghorn roosters were each fed 30 g of the respective SBM and excreta was collected for 42 hr. Crude protein (adjusted to 88% dry matter) ranged from 41.6 to 49.1%, crude fiber from 2.3 to 8.0%, and TME_n from 2132 to 2635 kcal/kg.

A linear regression equation was developed so as to predict metabolizable energy from crude fiber content:

TME_n (kcal/kg) = 3247 - 90 (% crude fiber), (dry matter basis). TME_n (kcal/kg) = 2857 - 79 (% crude fiber), (88% dry matter).

The prediction equations have an r² of 0.69.

Key Words: Soybean meal, Fiber, Metabolizable energy

159 Amino acid digestibility in turkeys. M. S. Lilburn*, The Ohio State University.

The digestibility of amino acids from common ingredients has been well established in chickens. Two procedures, total excreta collection following precision feeding and ileal digesta collection with the concomitant use of a non-digestible dietary marker, account for most of the published digestibility values. In broilers, Ravindran et al. (1999) utilized the dietary marker procedure and compared ileal and excreta amino acid digestibility values for a range of common ingredients. Their conclusion was that amino acid digestibility measured at the terminal ileum was preferable to excreta measurements. The semi-purified diets utilized by Ravindran et al. (1999), with some consideration given to species specific mineral requirements, were fed to 5 to 6 week old turkeys. During

the experiment, all birds were reared in Petersime growing batteries with metal pans beneath the wire floors. Digesta was collected from the terminal ileum between Meckels diverticulum and the ileo-cecal junction. The consistency of the excreta did not allow for accurate collection so quantitative measurement of excreta amino acid digestibility could not be determined for turkeys. Meat and bone meal is an extremely variable rendered protein source. The ileal amino acid digestibility estimates of the meat and bone meal used by Ravindran et al. (1999) were very close to those values measured in growing turkeys. Threonine had the lowest digestibility in broilers (0.46) and also in turkeys (0.51). The data suggests that ileal amino acid availability estimates for broilers and turkeys may be similar for some ingredients and if this is true for a wider range of ingredients, it might allow for greater use of broiler (chicken) digestibility estimates in turkey diet formulation.

Key Words: Turkeys, Amino acid, Digestibility, Ileum

160 Broiler chick utilization of threonine from fermentation by-product broth. W. A. Dozier, III¹, E. T. Moran, Jr.², and M. T. Kidd³, ¹The University of Georgia, ²Auburn University, ³Mississippi State University.

By-product fermentation medium after removal of crystalline threonine contains substantial residual amounts of this amino acid that may also be used as a feed additive. This study compared responses of male broilers from 1 to 21 d of age when fed L-threonine supplied by a feed grade (98.5%) crystalline source and a threonine by-product fermentation liquid (8%). A total of 1,008 Ross × Ross 308 male broiler chicks were randomly distributed into Petersime Batteries having a raised wire floor (12 birds/cage) at one d of age. A corn-peanut meal basal diet (0.55% Thr, 23% CP, and 3.20 kcal ME/g) was progressively supplemented with increasing amounts of crystalline and liquid sources of threonine to construct additional experimental diets having totals of 0.66, 0.73, and 0.80%. Balance of N and apparent metabolizable energy (AME) were measured from excreta collections on days 19 to 21. Slope-ratio assays indicated that relative bioavailabilities of threonine in an 8% by-product fermentation broth were 98.7, 100.8, and 100.2% for BW, feed conversion, and N retention, respectively. Birds consuming feeds supplemented with liquid threonine had greater feed consumption (1,188 vs 1,117 g; $P \leq 0.02$) and BW (709 vs 682 g; $P \leq 0.05$) compared with birds receiving the crystalline form; however, feed conversion, N retention, and AMEn indicated similar utilization for each source. Progressively increasing concentrations with both threonine sources led to a linear improvement in feed conversion ($P \leq 0.001$) for the entire period, which paralleled the linear increases in N retention ($P \leq 0.05$) and AME ($P \leq 0.001$) observed at the end. Although a feed conversion requirement for threonine could not be obtained, BW provided an estimate of 0.76% total threonine based on 95% of the upper asymptote. These data indicate threonine is not only necessary for essential amino acid balance but plays a critical role in recovery of metabolizable energy.

Key Words: Amino acid, Broiler, Threonine

161 Source, level and age differences in fat utilization by broilers. L. P. Machado², S. L. Vieira¹, and V. R. Quadros¹, ¹Universidade Federal do Rio Grande do Sul, ²Avipal S/A - Brazil.

The utilization of different sources of supplemental fat was investigated with broilers at 1 and 5 weeks of age in two trials. In each one, twelve one-day-old broiler chicks were placed in 40 steel battery cages, 1m² each. Experimental feeds were formulated with corn, soybean meal, and 8% cornstarch. Soybean oil, acidulated soybean soap stock and lard were added at the expense of 2, 4 and 8% cornstarch in the first trial, whereas coconut oil, palm oil, and palm kernel oil replaced cornstarch in the second trial. Feeds were provided to the birds from 1 to 7 and 28 to 35 days of age and total excreta produced in each cage was collected from 3 to 7 and 33 to 35 days of age, when feed intake was also measured. Regular starter and grower corn-soybean meal type diets were given to birds from 7 to 21 and from 21 to 28 days of age. Samples of feeds and excreta from the 1st and 5th week were submitted to acid hydrolysis and then ether extract determination and along with the different sources of fats had their gross energy determined in a Parr calorimeter. Metabolizability coefficients were calculated for the sources of fat and gross energy at the two ages, which allowed the estimation their MEs. Fat utilization was improved with the corresponding increases in supplementation regardless of bird age. However, the older birds metabolized all sources of fats more efficiently than the younger ones. This difference was also seen in the fat

ME values, which were 5% higher than with younger birds. Differences between fat sources were seen in both trials, with soybean and coconut oils providing more energy to the birds than their counterparts in the first and second trials, respectively. Differences in live performance resembled the utilization of fat obtained in the metabolism assay. Fatty acid profile, but also the type of fatty acid located at the C2 carbon in the glycerol, is known to affect fat digestibility. Fat sources used in the trials had major differences in these characteristics and were likely to have caused the alterations in animal responses.

Key Words: Broiler, Fat metabolizability, Metabolizable energy

162 Valine need of broiler males from 42 to 56 days of age. A. Corzo^{*1}, E. T. Moran, Jr.¹, and D. Hoehler², ¹Auburn University, ²Degussa Corporation.

The requirement of 0.70% valine for broilers from 42 to 56 days of age as advocated by NRC (1994) is based upon modeling. An experiment was conducted using Ross × Ross 308 males (32 floor pens; 25 chicks/pen) to examine its accuracy. All birds received common feeds from 0 to 42 days of age followed by diets having 0.60-0.81% valine to 56 days of age. A diet consisting of corn, soybean meal, and corn gluten meal (17% CP, 3.25 kcal/g ME, 1.57% leucine, and 0.74% isoleucine) was proven to contain 0.60% valine and served as the basal ration to which four 0.07% increments of L-valine were isonitrogenously substituted for L-glutamic acid. Data from each measurement were analyzed as orthogonal polynomials, and regression analysis estimated the most favorable level. Valine at 0.72% of the diet maximized body weight gain ($P < 0.01$) and feed consumption ($P < 0.05$) while 0.73% optimized F/G ($P < 0.01$). Depot fat removed from the abdominal cavity after processing was unaltered, and resultant carcass weights maximized at 0.72% valine ($P < 0.01$) in parallel with live weight gain. The front half of all carcasses was cone deboned, and 0.73% dietary valine was observed to maximize fillet recovery ($P < 0.01$). Fillet L* values obtained from light reflectance were unaffected by dietary valine; however, a* (redness) and incidence of blood contamination linearly increased as its level increased ($P < 0.05$). Alterations in tender yield and deep pectoral myopathy were not obvious ($P > 0.05$). Valine approximating 0.73% is expected to satisfy all needs of the broiler when used in conjunction with required levels of all other essential amino acids.

Key Words: Amino acid requirement, Broiler, Carcass quality, Valine

163 Excess dietary lysine improves weight gain in niacin-deficient chicks. N. R. Augspurger^{*} and D. H. Baker, University of Illinois at Urbana-Champaign.

Tryptophan (Trp) and lysine (Lys) catabolism share a common intermediary metabolite in α -ketoacidic acid. In Trp metabolism, this compound is produced three steps after the branch point of quinolinic acid production, which leads to the production of niacin. Therefore, the objective of these experiments was to determine the ability of excess Lys to improve the conversion of Trp to niacin through the buildup of α -ketoacidic acid, which would theoretically increase the production of quinolinic acid. Five assays were done using New Hampshire × Columbian male chicks. Five pens of four chicks were fed each experimental diet from d 8 to d 20 or 21 posthatching. The basal diet used for all assays was a semi-purified corn gluten meal diet fortified with crystalline amino acids to 22.5% CP and 9,600 mg/kg true digestible Lys. The basal diet contained an estimated 4 mg/kg of bioavailable niacin. The first assay determined the minimal true digestible Trp requirement in a niacin-adequate diet to be 1,600 mg/kg. The second assay determined the minimal niacin requirement of chicks fed a Trp-adequate, niacin-deficient diet to be 15.5 mg/kg. The third assay showed that excess Lys (10,000 mg/kg from L-LysHCl) improved weight gain in niacin-deficient (4 mg/kg) chicks but depressed weight gain in niacin-adequate (24 mg/kg) chicks (niacin × Lys interaction, $P < 0.01$). The fourth assay was done to determine the effect of excess Lys (10,000 mg/kg from L-LysHCl) on niacin utilization. Excess Lys again improved ($P < 0.01$) weight gain of niacin-deficient chicks. A fifth assay showed increased ($P < 0.10$) weight gain of chicks fed excess Lys from either L-LysHCl or L-Lys acetate, but showed no effect ($P > 0.10$) of quinolinic acid (8 mg/kg) or picolinic acid (4,210 mg/kg) on weight gain of chicks fed a niacin-deficient, Trp-adequate diet. The results of these trials suggest that excess Lys leads to an accumulation of α -ketoacidic acid, which causes end-product inhibition of the main Trp catabolic pathway to CO₂,

therefore increasing flux of 2-amino-3-carboxymuconate semialdehyde to nicotinic acid mononucleotide and NAD.

Key Words: Niacin, Tryptophan, Lysine, α -keto adipic acid, Quinolinic acid

164 Iodine toxicity in young chicks. T. M. Parr*, N. R. Augspurger, M. E. Persia, C. V. Delgado-Reyes, T. A. Garrow, and D. H. Baker, *University of Illinois*.

In an attempt to study Met bioactivity in S-methyl Met, synthesized as the iodide (I) salt, we unwittingly encountered I toxicity, i.e., poor growth and a peculiar type of paralysis. Battery trials were therefore conducted to quantify I toxicity in male crossbred chicks fed various diets. In all cases, four pens of four chicks were ad libitum fed experimental diets during assay periods ranging from 9 to 13 d. An initial 9-d trial involved a 3 x 2 x 2 factorial arrangement of treatments: three levels of supplemental I (0, 600, and 1,200 mg I/kg from potassium iodide), two protein levels (13 and 18%) from soybean meal (SBM) and two levels of supplemental DL-Met (0 and 0.42%). The 13 and 18% CP Met-deficient basal diets contained 0.77 and 0.78 mg I/kg, respectively. Linear ($P < 0.01$) depressions in weight gain and feed intake occurred with increasing doses of added I, but the gain depressions were greater ($P < 0.01$) at 18% than at 13% CP. At both CP levels, Met elicited gain and feed efficiency responses ($P < 0.01$), but I additions depressed gain/feed linearly ($P < 0.01$) only in diets without supplemental Met. A 23% CP corn-SBM diet (0.95% Met + Cys, 0.78 mg I/kg) was used in the next trial in which supplemental I levels of 300, 600, 900, and 1,200 mg/kg were fed for 13 d. With this diet, none of the I levels depressed feed efficiency ($P > 0.10$), and only the 900 and 1,200 mg/kg I levels decreased weight gain. Moreover, neither hemoglobin nor hematocrit were affected ($P > 0.10$) by any of the I levels. Thus, supplemental I levels of 600 mg/kg (1,700 times requirement) were well tolerated by young chicks fed Met-adequate corn-SBM diets, whereas this level of I was markedly growth depressing in chicks fed SBM semipurified diets, particularly when Met was deficient.

Key Words: Iodine, Protein level, Methionine, Growth, Hemoglobin

165 Effect of wet feeding wheat-based diets on broiler performance and nutrient retention. T. A. Scott*, *Agriculture and Agri-Food Canada, Pacific Agri-Food Research Centre, PO Box 1000, Agassiz BC V0M 1A0*.

Two studies were conducted to determine the effect of wheat source on voluntary feed intake when diets were offered in a wet or dry form. The first experiment was designed to establish if a mould inhibitor was necessary. The second experiment allowed more extensive screening of wheat types to determine if there is a genetic component in wheat that explains the differences observed in Experiment 1. Experiment 1 was based on two wheat cultivars (Hard Red Spring (HRS) and Durum). Each wheat was ground, one portion used as is, the other pelleted and re-ground. The four wheat sources were included at 80% of a standard bioassay diet (with enzyme) and each diet was fed with or without propionic acid. The eight diets were fed ad libitum as is or with 1.2 g water per g feed. The wet diets were prepared daily and all diets were fed to four groups of six male broilers from 1 to 17 d of age. The second experiment utilized three cultivars each of HRS and Durum wheat fed in similar bioassay diets with no pre-pelleting or added mould inhibitor; each diet was fed with or without enzyme. Each of the 12 diets in the second experiment was fed with and without 1.2 g water per g feed to six groups of eight male broilers from 1 to 21 d of age. For both experiments, the daily intake of feed, on an air dried basis, was determined for each diet and used to calculate feed conversion for the respective feeding periods. Experiment 1 showed no effect of supplementing the wheat-based diets with propionic acid. This same experiment also clearly showed that feed intake was increased with wet feeding and that there were significantly greater effects when HRS as compared to Durum wheat was fed. Experiment 2 clearly established that there are distinct differences in voluntary feed intake with wet feeding utilizing HRS as compared to Durum wheat. This experiment indicated that wet feeding mimics enzyme supplementation with regard to lowering digesta viscosity, but is clearly unique from enzyme supplementation with its large effect on feed intake and growth. These studies support our hypothesis that variability in hydration rate of cereal-based diets may limit intake.

Key Words: Wheat, Wet feeding, Enzymes, Feed intake, Broilers

166 Comparison of wheat bran phytase and a commercially available phytase on turkey tom performance and litter phosphorus content. K. D. Roberson¹, T. J. Applegate², J. Kalbfleisch*¹, and W. Pan¹, ¹*Michigan State University, East Lansing, MI*, ²*Purdue University, West Lafayette, IN*.

A 12 wk turkey study evaluated the effect of wheat bran phytase versus a commercially available phytase (Natuphos 600[®]) on growth performance, and the amount and forms of litter phosphorus (P). At 5 wk of age, 780 Hybrid Converter turkey toms were randomly allocated into 32 floor pens with 23 to 26 birds/pen (average tom starting weight=1.74 kg). A corn-soybean meal based mash diet was phase fed at 3 wk intervals. Four dietary treatments were fed with 8 replicates. Treatments consisted of T1: control (0.50, 0.44, 0.38, or 0.35% non-phytate P (npP) at 8, 11, 14, or 17 wk, respectively), T2: negative control (subtracting 0.1 percentage units of npP from T1 and 0.2 percentage units of Ca from T1 to maintain 2:1 Ca:npP), T3: Ca and P levels as T2 with 3.27% wheat bran (900 units/kg phytase activity), T4: Ca and P levels as T2 + Natuphos[®] (900 units/kg, 5-11 wk; 600 units/kg, 11-17 wk). Measurements included BW, feed:gain (F:G), and litter P (soluble P, total P, soluble/total P). T1 produced the greatest BW at all age periods ($P < 0.05$). At 8 and 14 wk of age, T3 and T4 had similar BW compared to T2. At 11 wk, T4 had higher BW than T2 ($P < 0.001$). At 17 wk, T3 had greater BW compared to T2 (15.27 vs. 14.87 kg; $P < 0.001$), but not different from T4. From 5-17 wk, T1 had improved F:G over T2 and T4 ($P = 0.012$). T2, T3 and T4 had similar F:G. T4 litter soluble P was greater than T2 (T1: 0.19%; T2: 0.16%; T3: 0.18%; T4: 0.20%; $P = 0.046$). Total P was decreased by 26-28% when T3 or T4 was fed compared to T1 ($P = 0.006$). Soluble P as a proportion of total P was greatest in T3 and T4 and significantly greater than T1 (T1: 14.9; T2: 16.7; T3: 19.3; T4: 22.3; $P < 0.002$). Feeding wheat bran phytase yielded similar growth, litter soluble P, total P and soluble P as a proportion of total P as Natuphos[®]. Litter soluble P from Natuphos[®] was not different from control.

Key Words: Turkey, Phytase, Soluble P, Wheat bran

167 Efficacy of phytase and citric acid for broiler chicks fed a phosphorus-deficient corn-soybean meal diets. M. Metwally*, *Faculty of agriculture, Assiut University, Assiut, EGYPT*.

The present study was performed to evaluate the individual and combined effects of microbial phytase (Natuphos) and citric acid for improving phytate-phosphorus utilization in corn-soybean meal broiler diets from hatch to 42 days of age. A 3x3 factorial treatment arrangement was conducted using 270 one-d old unsexed Hubbard broiler chicks. Three levels of phytase, 0, 250 and 500 FTU/kg, and 3 levels of citric acid, 0, 1.5 and 3% were used. Birds were chosen randomly and equally divided into 9 groups (30 birds each). Chicks were fed complete control basal diet according to NRC from day 1 to 7. From day 8 to 42 days of age, birds were fed the experimental diets. The obtained results showed that there were significant ($P < 0.05$) effect of individual and combined phytase and citric acid on live body weight at 2, 3, 4 and 6 wks of age. At 42 d of age, live body weight significantly ($P < 0.05$) increased as phytase and citric acid increased. Body weight gain, feed intake and feed conversion were significantly ($P < 0.05$) affected by individual and combined phytase and citric acid. Chicks fed 250 units of phytase and 3% citric acid had significantly higher body weight and feed conversion and lower feed intake compared with the control birds. Absolute bursa and relative bursa and thymus weight were significantly ($P < 0.05$) affected by phytase and citric acid at 4 wks of age. At 6 wks of age, absolute liver and spleen and relative spleen weight were significantly ($P < 0.05$) by individual and combined phytase and citric acid. Plasma Ca, P, toe and tibia ash were significantly affected by the treatment at 4 wks of age. Chicks fed 250 FTU/kg of phytase had significantly increased tibia ash compared with control. The increase in tibia ash at 42 d of age of bird fed diet supplemented with 250 units of phytase represents 12.14% over that of birds consuming the control diets. The results of this study revealed that dietary phytase at 250 units/kg and 3% citric acid effectively improved phytase phosphorus utilization in broiler chicks.

Key Words: Phytase, Citric acid, Corn-soybean meal diets, Broiler chicks, Blood