

## ABSTRACTS

Monday, August 1, 2005

### POSTER PRESENTATIONS

\*Author Presenting Paper

*(Presenters must be present from 9:30 AM - 11:30 AM)*

**M1 A further examination of the role of dietary protein in regulating metabolism in the broiler.** R. Rosebrough\*, B. Russell, S. Poch, and M. Richards, *ANRI-USDA, Beltsville, Maryland.*

Two experiments were conducted with Hubbard × Hubbard broiler chickens to further delineate the role of dietary protein as a regulator of lipid metabolism. In both experiments, birds were fed one of two diets (12 or 30% protein) from 7 to 28 days of age. Likewise, in both experiments, birds were switched to the opposite level of dietary protein. However, in the first experiment, birds were selected and killed at 12, 18 and 24 hr following the dietary reversals. Birds were sampled at 3, 6, 9, 12, 18 and 24 hr in the second experiment. In vitro lipogenesis (IVL) was determined by the incorporation of [14C]acetate into hepatic lipids and was indicative of acetyl CoA carboxylase activity (AcCbx). Activities of certain metabolic enzymes and genes controlling these enzymes (malic enzyme, ME; fatty acid synthase, FAS; isocitrate dehydrogenase, ICD; aspartate aminotransferase, AAT and AcCbx) were also measured. In all experiments switching dietary treatments increased and decreased lipogenesis as birds were switched from 30 to 12% protein and from 12 to 30% protein diets, respectively. The greatest rates of change elicited by either regimen occurred by the first day of each reversal (Exp 1). A further examination (Exp 2) indicated significant changes in IVL 12 hr post reversals. Changes in IVL were correlated to changes in the expression of genes for both FAS and AcCbx. In addition, this observation validated our original hypothesis that IVL approximated AcCbx activity. Changes in gene expression always preceded changes in intermediary metabolism, indicating that responses to dietary protein involved some alterations in gene activity. Of the three hepatic enzymes monitored, ME activity most closely followed the rapid changes in IVL. Likewise, ME gene expression was both highly correlated to activity changes and most affected by these dietary reversals.

**M2 Influence of red pepper, green tea supplemented diets varying in protein levels on the growth performance, feed consumption, feed conversion ratio, carcass characteristics and economic efficiency of broiler chicks.** A. Eldeek\*, *University of Alexandria, Alexandria, Egypt.*

A study was conducted to evaluate the addition of two levels 0.15% and 0.3% of red pepper (RP) and green tea (GT) as alternative growth promoters compared to 0.01% oxytetracycline (OTC) to corn soybean diets. Two diets were formulated to contain 21% and 23% protein (P) with the same level of metabolizable energy (ME) 3155 Kcal/kg diet.

A total of 216 one-day old broiler chicks were randomly assigned into 12 experimental groups of 3 replicates. Body weight (BW), Body weight gains (BWG), feed consumption (FC), feed efficiency (FE), carcass characteristics and economic efficiency (EE) were collected at 21 and 45 days of age.

Results at 45 days showed that BW, FC and FE increased significantly and numerically for the whole period of age with the additives RP at 0.15% and 0.3%, respectively as compared to either the control group or the OTC fed group. Also, broilers fed diets with 21% P and GT at 0.15% had greater BW as compared to any other dietary treatment fed group. All dietary treatments did not significantly affect BWG.

Better percentage of carcass characteristics resulted for chicks fed alternative additives when compared to the dietary P. Dressing % were higher in chicks fed 21% P and those fed RP 0.15%, and GT 0.3%, respectively. Abdominal fat showed similar manner to dressing % with RP 0.3%, and GT 0.15%, respectively. Gizzard % was superior for chicks fed 21% P and OTC, 23% P with GT 0.15% and 0.3%, respectively. Kidney% was superior for broilers fed 23% P alone or 23% P with either RP 0.15% or .3%, respectively.

Birds given 0.15% GT at 21% P showed the best EE 126.5% where at 23% P, the RP 0.15% was better 121.9% compared to the control group.

The results showed that the RP and GT additives were as effective as the antibiotic growth promoters regardless of protein levels.

**Key Words:** Performance, Broiler, Red pepper

**M3 Effect of organic selenium (Sel-Plex) in combination with alfa-tocopherol (Vit. E) on fresh and frozen poultry meat.** O. Pesut<sup>1</sup>, L. Nollet<sup>\*2</sup>, and L. Tucker<sup>2</sup>, <sup>1</sup>Faculty of Veterinary Medicine, Belgrade, Serbia & Montenegro, <sup>2</sup>Alltech Biotechnology Centre, Dunboyne, Meath, Ireland.

The objective of the research was to determine the antioxidative effect of Se provided as Sel-Plex in combination with vit. E (100 IU/kg feed) on poultry breast and thigh meat. Birds (Arbor Acres) were supplemented with 0, 0.05, 0.10 and 0.30 ppm Se from Sel-Plex (Alltech Inc., USA) with or without 100 IU vit. E/kg of feed for 42 days. At 42d, broilers were sacrificed and breast and thigh muscle tissues homogenized. Part of the fresh sample was used for the determination of thiobarbituric acid reactive substances (TBARS, expressed as mg MDA/kg), while the remainder of the sample was packed in tightly closed plastic containers and kept at -20°C for 16 weeks. Results were analysed using ANOVA followed by a Student t-test. Analysis of fresh meat samples indicated that TBARS values were reduced ( $P < 0.01$ ) in the breast and thigh muscle by supplementation of 0.05 ppm Se, with or without vit. E. Supplementation of 0.05 ppm Se reduced MDA levels to the same degree as 100 IU/kg vit. E in breast (0.34 mg/kg for Se and 0.32 mg/kg for vit. E vs 0.47 mg/kg for the control) and in thigh (0.52 mg/kg for Se and 0.48 mg/kg for vit. E vs 0.69 mg/kg for the control). Supplementation of vit. E in combination with 0.05 ppm Se reduced TBARS in breast and thigh further to 0.30 ( $P > 0.05$ ) and 0.43 ( $P < 0.05$ ), respectively. Increasing dietary Se up to 0.3 ppm reduced TBARS in breast and thigh muscle further to values of 0.24 mg/kg and 0.43 mg/kg, respectively, while at these levels the supplemental vit. E had no additional effect. Analysis of TBARS in breast and thigh muscle after frozen storage demonstrated that 0.1 ppm Se from Sel-Plex had a similar antioxidative effect as 100 IU/kg vit. E. Also, increasing the Se concentration up to 0.3 ppm reduced TBARS ( $P < 0.05$ ) compared to the 0.1 ppm Se level, and adding vit. E on top of the Se supplementation had a non-significant effect in breast muscle and a significant ( $P < 0.05$ ) effect on TBARS in thigh muscle. It can be concluded from this trial that Sel-Plex exerts a conserving activity on broiler meat during storage and that supplemental vit. E has a large additional effect at low dietary Se concentrations.

**Key Words:** Selenium, Meat quality, Broiler

**M4 Influence of red pepper, green tea supplemented diets varying in protein levels on the immune system, microbial count, test panel evaluation and plasma constituents of broiler.** A. Eldeek<sup>\*</sup>, University of Alexandria, Alexandria, Egypt.

A study was conducted to evaluate the addition of two levels 0.15% and 0.3% of red pepper (RP) and green tea (GT) as alternative growth promoters compared to 0.01% oxytetracycline (OTC) to corn soybean diets. Two diets were formulated to contain 21% and 23% protein (P) with the same level of metabolizable energy (ME) 3155 Kcal/kg diet.

A total of 216 one-day old broiler chicks were randomly assigned into 12 experimental groups of 3 replicates. Immune system, microbial count, test panel evaluation and plasma constituents of broiler were measured at 21 and 45 days of age.

Results showed that white blood cells at 45 days were higher with 23% P as compared to the 21% P group. Also, they were higher in group fed RP 0.15%, GT 0.15%, OTC and the control group, respectively with the higher count at 23% P with OTC fed group of 123.50 ( $10^3/\text{mm}^3$ ). Newcastle virus disease (NVD), Bronchitis Disease (IB), Infectious Bursal Disease (IBD) or Gumboro (GB) immunity tests at 21 days showed that immunity was not affected by any of the dietary treatments. Gram positive bacterial count showed that 21% P with OTC had higher bacterial count at both periods, respectively.

Results of test panel showed that taste, tenderness, and acceptability at 21% P were better as compared to 23% P. However, flavor was better at 23% P. Also, the best acceptability was obtained with GT at 0.3%. An interaction between 21% P and RP 0.15% resulted in better color of meat, and the same was true for GT 0.3%.

Triglycerides (TG) had superior values at 23% P alone or with GT 0.3% as compared to the 21% group. Furthermore, the control group over passed all tested feed additive in TG of 40.16 mg/100ml, with no interaction effect. However, total lipids and total cholesterol were not affected by any of the tested

additives and followed the same trend as the first period.

It is concluded that RP and GT can be included in the broiler diets at level 0.15% and 0.3% without any adverse effect on the previous traits.

**Key Words:** Red pepper, Green tea, Broiler test panel

**M5 The effect of feeding *Solanum glaucophyllum* on eggshell strength in second-cycle White Leghorn hens.** J. Fuller, Jr. <sup>\*1</sup>, J. Goff<sup>2</sup>, B. Behrends<sup>3</sup>, S. Nissen<sup>4</sup>, and R. Horst<sup>2</sup>, <sup>1</sup>MTI, Ames, IA, <sup>2</sup>NADC, Ames, IA, <sup>3</sup>Sparboe Companies, Litchfield, MN, <sup>4</sup>Iowa State University, Ames.

*S. glaucophyllum* is a plant which contains naturally occurring glycosides of 1,25-(OH)<sub>2</sub>D<sub>3</sub>. It was hypothesized that feeding the glycoside form of the vitamin would result in hydrolysis in the gut of the laying hen releasing active 1,25-(OH)<sub>2</sub>D<sub>3</sub> and improving calcium metabolism and eggshell strength. Four-hundred-thirty-two SCWL hens 70 wk of age were obtained from a commercial flock just before starting a second laying cycle. After a 20 wk period of production on a commercial laying hen diet, the hens were put on the experimental diets. A randomized block design was used such that each treatment replication (3 adjacent cages with 2 hens each and a common feeder) was repeated once in each of the 8 rows of cages in the house. Treatments consisted of a 3 by 3 factorial design with either 2.5, 3.0, or 3.5% calcium in the diet and either 0, 5, or 10 g of dried *S. glaucophyllum* leaves per kg of feed. Egg specific gravity and breaking strength were measured during week 7. Plasma 1,25-(OH)<sub>2</sub>D<sub>3</sub> levels were measured after the 10 wk feeding period. Feeding *S. glaucophyllum* resulted in significant increases in active vitamin D in the blood, egg breaking strength and egg specific gravity. No differences in egg production were observed over the 10-wk feeding period. In conclusion, feeding *S. glaucophyllum* increased the active vitamin D metabolite in the blood and resulted in stronger eggshells while not affecting egg production.

**Effect of *S. glaucophyllum* on 1,25-Vitamin D, eggshell strength, egg specific gravity and egg production in second-cycle SCWL hens**

|  | g/kg Diet |        |        | p < (SEM)*     |
|--|-----------|--------|--------|----------------|
|  | 0         | 5      | 10     |                |
| Plasma 1,25-(OH) <sub>2</sub> D <sub>3</sub> , pg/mL | 417       | 521    | 720    | 0.001 (32)     |
| Wk 7 breaking strength, g                            | 3912      | 4238   | 4076   | 0.003 (61)     |
| Wk 7 specific gravity                                | 1.0747    | 1.0769 | 1.0753 | 0.006 (0.0004) |
| Hen housed egg production, %                         | 79.9      | 78.5   | 78.2   | 0.54 (1.2)     |

\*p values and SEM are for the combined effect of *S. glaucophyllum* (GLM model with row, *S. glaucophyllum*, calcium and the interaction).

**Key Words:** Vitamin D, Egg specific gravity, Egg shell strength

**M6 Effects of ingredient composition and processing of pre-starter diet and age of the breeders on the performance of chicks and broilers.** R. Amaral<sup>2</sup>, J. F. M. Menten<sup>\*1</sup>, A. M. C. Racanicci<sup>1</sup>, and J. Lecznieski<sup>2</sup>, <sup>1</sup>ESALQ-USP, Piracicaba, SP, Brazil, <sup>2</sup>Agribands Purina do Brasil, Paulínia, SP, Brazil.

The type and quality of the ingredients (vegetal vs. animal origin) of a pre-starter diet and processing (mash vs. pelleted/crumbled form) may affect the economical and performance results of broiler production. Chicks of different initial weight may have the digestive system differently adapted to those nutritional variables. The purpose of this study was to evaluate the effects of breeder age, composition and physical form of the pre-starter diet (supplied from 1 to 7 d) on the performance of male chicks to 7 days and of broilers to 42 days of age. Young or mature AgRoss broiler breeders (32 vs. 55 wk) produced light or heavy chicks (38±2 vs. 50±2g) which were allotted to dietary treatments from 1 to 7 days consisting of all-vegetal vs. feed containing animal products and fed as meal vs. crumbled form. Treatments were arranged in a 2X2X2 factorial, with 4 replicates of 45 birds, in a randomized complete block design. After 7 days all birds received the same starter, grower and finisher diet. Chicks from mature breeders had greater weight gain in the first week (129 vs. 108g,  $P = 0.05$ )

which persisted to 42 d (2.871 vs. 2.670kg,  $P=0.05$ ). Crumbled feed also resulted in improved weight gain to 7 d (130 vs. 108g,  $P=0.05$ ) which was maintained to 42 d (2.822 vs. 2.718kg,  $P=0.05$ ), but the ingredient composition of the pre-starter diet did not affect gain ( $P=0.05$ ). Feed intake was not affected by dietary treatments but was higher for chicks and broilers from mature hens ( $P=0.05$ ). Feed conversion rate, averaging 1.303 from 1 to 7 d and 1.781 from 1 to 42 d, was not affected by treatments ( $P=0.05$ ). This study demonstrated that (a) regardless of feed composition and chick weight, crumbled diet from 1 to 7 d was beneficial to performance until market weight; (b) all-vegetal feed for baby chicks was not detrimental to overall performance; (c) light weight chicks benefited more at 42 d than heavier chicks when fed crumbled diet.

**Key Words:** Pre-starter diet, Breeder age

**M7 Effects of alfalfa based molt diets on skeletal integrity of White Leghorns.** W. K. Kim<sup>\*1</sup>, C. S. Dunkley<sup>1</sup>, P. Y. Hester<sup>2</sup>, L. F. Kubena<sup>3</sup>, D. J. Nisbet<sup>3</sup>, and S. C. Ricke<sup>1</sup>, <sup>1</sup>Texas A & M University, College Station, <sup>2</sup>Purdue University, West Lafayette, IN, <sup>3</sup>USDA-ARS, Southern Plains Agricultural Research Center, College Station, TX.

A study was conducted to evaluate effects of alfalfa based molt diets on bone qualities using conventional bone assays and dual energy X-ray absorptiometry (DEXA). Sixty White Leghorn hens (64 wk of age) were assigned to 1 of 6 treatments: pretrial control (PC), full fed (FF), 9-d feed withdrawal (FW), A90 (90% alfalfa/10% layer ration), A80 (80% alfalfa/20% layer ration), and A70 (70% alfalfa/30% layer ration). Water and diets were consumed ad libitum. Hens were placed on 8L:16D 1 wk before molt and were maintained on this light restriction throughout the study. For the PC, hens were euthanized and bones collected immediately before light restriction. After hens were fasted or fed different molt treatment diets for 9 d, they were fed a maintenance diet for 14 day. On Day 23 post molt, hens were euthanized and bones collected. Feed intakes/hen of the FF, A90, A80, and A70 during a 9-d molting period were 96, 26, 44, and 46g, respectively. Tibia dry weight of the PC was higher than the FF group ( $P<0.05$ ), but did not differ from the other molt treatments. The PC group had significantly higher tibia ash weight than the FF, FW, A90, and A80 groups. Tibia ash concentration of the PC group was significantly higher than the FF, A90, and A80. Humerus dry weights of the PC group were higher than the other groups except for hens on FW. Humerus ash weight was lower ( $P<0.05$ ) for FF hens as compared to PC hens, but other molt treatments had humerus ash weights similar to PC hens. The DEXA results were in agreement with ash weights. Tibia mineral content and density of the PC were significantly greater than the other treatments. The FF group exhibited significantly lower humerus mineral content and density compared to those of the PC group, but did not differ from other molt treatments. In conclusion, hens on Day 23 of molt experienced deterioration in skeletal integrity. This decrease in bone quality occurred in all molted hens. Use of non-fasted molt regimens in which light restricted hens consumed either a laying hen diet or varying concentrations of alfalfa based molt diets had poor quality on Day 23 post-molt that did not differ from hens subjected to a 9 day fast.

**Key Words:** Molt, Alfalfa, Bone density

**M8 Oxidative stability of frozen thigh meat from broilers fed oxidized poultry offal fat.** A. M. C. Racanicci, J. F. M. Menten<sup>\*</sup>, M. A. A. Regitano-d'Arce, and L. M. Pino, *Escola Superior de Agricultura Luiz de Queiroz - USP, Piracicaba, SP, Brazil.*

Lipid oxidation is one of the most important processes of quality loss in meat systems, associated with unsaturated lipids and caused by different factors including content and quality of dietary fat ingested by the animals. Thus, two experiments were conducted to evaluate the effects of dietary oxidized poultry offal fat on performance of broilers and on oxidative stability of dark chicken meat during frozen storage. Two hundred male AgRoss broiler chicks were raised in floor pens and fed a corn-soybean meal diet containing 4% fresh (FPF) or oxidized (OPF) poultry fat from 10 to 40 days of age. Treatments (FPF and OPF) were arranged in a randomized complete block design, with 4 replicates of 25 birds. FPF was supplied by a local renderer and stored frozen (-18°C) until diets were produced and OPF was obtained by electrical heating (110-120°C for 20 days). Samples were taken from FPF and OPF and analyzed to

monitor its quality using specific absorbances at 232 and 270 nm to quantify oxidation products (5.80 and 0.69 for FPF and 11.33 and 2.31 for OPF at 232 and 270 nm, respectively). Sixty-eight birds from each treatment were slaughtered at 41 days of age and skinless and deboned thigh meat was packed and stored frozen (-18°C) during 9 months. Meat samples were collected monthly to assess the oxidative stability. Thiobarbituric acid reactive substances (mg of malondialdehyde-MAD per kg of meat) were measured in duplicate of 3 thighs of each treatment in order to evaluate the formation of secondary lipid oxidation products. Dietary OPF did not affect weight gain, feed intake or feed conversion rate ( $P=0.05$ ), however induced depression on oxidative stability of thigh meat after 6 months of frozen storage. TBARS values were higher for OPF at 6 months (0.453 vs. 0.613 mg MDA/kg,  $P=0.10$ ) and at 7 months (0.469 vs. 0.775 mg MDA/kg,  $P=0.05$ ) compared to FPF.

**Key Words:** Lipid oxidation, Meat quality, TBARS

**M9 Broiler live performance on wheat-based feeds supplemented with mannan oligosaccharides.** J. P. Blake<sup>1</sup>, J. B. Hess<sup>\*1</sup>, K. S. Macklin<sup>1</sup>, S. F. Bilgili<sup>1</sup>, T. Sefton<sup>2</sup>, and A. Kocher<sup>3</sup>, <sup>1</sup>Auburn University, Auburn, Alabama, <sup>2</sup>Alltech, Nicholasville, Kentucky, <sup>3</sup>Alltech, Meath, Ireland.

Broilers were placed at 0.84 ft<sup>2</sup>/bird on three treatments (10 pens/trt). Treatments included an unmedicated control (CON), 50 ppm Bacitracin Methylol Disalicylate (BMD) or mannan oligosaccharide (MOS) (Bio-mos, Alltech, Nicholasville, KY) in a three feed program. MOS levels were 1816 g/ton, starter; 908 g/ton, grower; and 454 g/ton, withdrawal. Feeds were corn-wheat-soy based with 30% wheat and 600 units/ton of xylanase (Allzyme PT, Alltech, Nicholasville, KY). Starter was fed at 0.8 kg/bird, with birds fed 1.6 kg of grower and withdrawal to termination. Broilers were started on new litter to look at results over successive flocks. Two trials are discussed in this abstract. Broilers and feed were weighed at 14 d, 28 d and at the end of the trials.

In Trial 1, BW at 14 days were highest with BMD (411.3 g) with CON lowest (394.9 g) and MOS intermediate (396.3 g). Feed consumed was highest for BMD (482.7 g/bird) and lowest for MOS (470.8 g/bird). FCR was lowest in CON, and higher in the two treated groups with better BW. Body wt differences were not significant at 28 d, although FCR differences from 14 to 28 d were similar to that seen at 14 d (1.59 CON, 1.60 MOS, 1.65 BMD). BW were not different at 34 d (avg. 1.77 kg), while FCR were lowest for MOS (1.64) and CON (1.64) vs BMD (1.68). Mortality was low (2.0%) and did not differ between trt.

In Trial 2, No differences in BW or FCR were recorded at 14 d. At 29 d, BMD showed the heaviest BW (1.43 kg) with MOS second (1.39 kg) and CON third (1.35 kg). BW gains showed a similar pattern between 14 and 29 d. Mortality was lower for the MOS (0.41%) and BMD (0.83%) than CON (2.04%) from 14 to 29 d. BW at 37 d were highest in BMD (2.14 kg), second in MOS (2.10 kg) and lowest in CON (2.07 kg). FCR was lowest in MOS (1.69), with BMD (1.72) intermediate and CON (1.73) highest. Mortality (6.8%) was higher than in trial 1, but did not differ between trt. In general, BMD and MOS influenced final BW and FCR on used litter.

**Key Words:** Mannan oligosaccharides, Broilers, Wheat

**M10 Cardiac and hepatic tissue fatty acid composition of broilers dying due to sudden death syndrome.** G. Cherian<sup>\*</sup>, M. P. Goeger, and J. C. Hermes, *Oregon State University, Corvallis.*

Cardiac and hepatic tissue fatty acid composition of birds dying due to sudden death syndrome (SDS) in a broiler flock of 9,200 maintained at Oregon State University was determined. The birds were fed a commercial broiler diet during a 42-day feeding trial and were kept in an environmentally controlled house. A total of 30 birds dying due to SDS were obtained and heart and liver tissue was collected. A total of six healthy birds from the same flock were also sacrificed and tissues (liver, heart) were collected and treated as control. These tissues were selected due to their respective roles in lipid assimilation (liver) and oxidation (heart). The total fat content of cardiac and hepatic tissue was higher for SDS than control birds ( $P<0.05$ ). The content of eicosapentaenoic acid (20:5n-3) was significantly lower in the liver and heart of SDS ( $P<0.05$ ) than control birds. Deposition of arachidonic acid (20:4n-6) was higher in liver and heart

triglycerides and heart phosphatidylcholine and phosphatidyl ethanolamine fractions of SDS birds than control ( $P < 0.05$ ). Total monounsaturated fatty acids were higher in heart phosphatidylcholine, phosphatidyl ethanolamine and cholesterol ester fractions of SDS birds than control ( $P < 0.05$ ). The content of saturated fatty acids were higher in the liver phosphatidylcholine fractions of SDS birds than control ( $P < 0.05$ ). The significant alteration in saturated, mono and polyunsaturated fatty acids suggests an impairment in fatty acid metabolism affecting the synthesis and tissue deposition of long chain n-3 and n-6 fatty acids in SDS birds.

**Key Words:** Broiler, Sudden death syndrome, Polyunsaturated fatty acid

**M11 Effect of dietary methionine sources on intestinal bacterial populations in broiler chickens.** J. P. Dahiya, D. C. Wilkie, A. G. Van Kessel, and M. D. Drew\*, *University of Saskatchewan, Saskatoon, SK, Canada.*

The amino acid content of broiler diets has a significant effect on gut *Clostridium perfringens* populations and may predispose birds to necrotic enteritis. Previous work in our laboratory showed that methionine hydroxy-analogue (MHA-FA) is more available to gut bacteria than DL-methionine (DL-Met) and may stimulate the growth of gut bacterial populations including *C. perfringens*. An experiment was therefore conducted to study the effect of various levels of DL-Met or MHA-FA on *C. perfringens* and other intestinal bacterial in broiler chickens. Two cages of 6 birds (14 d post-hatch) were assigned to one of 7 different diets containing no added methionine (control); 2.0, 4.0 or 8.0 g/kg DL-Met or 2.27, 4.54 and 9.08 g/kg MHA-FA, thus providing 3 equimolar levels of each methionine source. The control diet was formulated to contain 220 g/kg crude protein, 12.0 g/kg lysine, 3.8 g/kg methionine and 3.20 Mcal/kg of ME. All birds were orally gavaged with a *C. perfringens* type A broth culture from d 14 to 20 and euthanized on d 28. Intestinal populations of *C. perfringens*, lactobacilli, enterococci, enterobacteriaceae and group D streptococci were counted in ileum and cecum and intestinal lesions were scored. There were no significant effects of methionine source or level on the numbers of lactobacilli, enterococci or enterobacteriaceae in ileum or cecum. Populations of group D streptococci were significantly decreased ( $P < 0.05$ ) in the ileum in birds fed 4.54 g/kg MHA-FA diets compared to the controls (5.12 vs. 6.02  $\text{Log}_{10}$  colony forming units/g contents; (CFU/g)). *C. perfringens* populations were significantly reduced in ileum in birds fed the 4.0 g/kg level of DL-Met compared to the controls (0.00 vs. 3.08  $\text{Log}_{10}$  CFU/g) and in ceca of birds fed the 4.0 g/kg level of DL-Met or the 2.57 g/kg level of MHA-FA compared to the controls (0.76, 1.30 and 5.22  $\text{Log}_{10}$  CFU/g respectively). Intestinal lesion scores were not significantly affected by methionine source or level. The results suggest that both DL-Met and MHA-FA may reduce intestinal populations of *C. perfringens* in broiler chickens.

**Key Words:** Methionine sources, Necrotic enteritis, Broiler chickens

**M12 Titration of spray-dried plasma in pelleted feed on broiler performance.** J. M. Campbell\*, J. D. Crenshaw, and L. E. Russell, *APC, Inc., Ankeny, Iowa.*

An experiment was designed to evaluate titrated levels of spray-dried plasma (SDP) in feed on broiler performance. Two hundred forty Ross x Ross 308 male broilers were randomly assigned to one of five dietary feeding programs (6 broilers per pen and 8 pens per treatment). Broilers were housed in pens with used litter to simulate commercial conditions. The feeding program consisted of three phases with starter from d 0 to 14, grower from d 15 to 28, and finisher from d 29 to 42. Within phase, corn-soybean meal based dietary treatments were formulated to be equal in lysine and metabolizable energy. All diets were conditioned for 15 seconds at 85°C then pelleted through a 4 mm x 32 mm die. Dietary treatments were control (0% SDP) and SDP (1.0, 0.75, 0.5, and 0.25% phase 1; 0.5, 0.375, 0.25, and 0.125% phase 2; and 0.25, 0.18, 0.125, 0.062% phase 3, respectively) mixed into the mash and then pelleted. Broilers were vaccinated on d 7 and 14 with Bursal Disease and Newcastle-Bronchitis vaccine, respectively. From d 0 to 42, average daily gain, feed intake and body weight at d 42 were linearly increased ( $P < 0.05$ ) due to increasing levels of SDP. Feed efficiency from d 0 to 42 resulted in a quadratic ( $P < 0.05$ ) response to increasing levels of SDP. No differences ( $P > 0.05$ ) were noted in survival.

All levels of SDP improved broiler performance, but combined performance improvements were optimal when 0.75% SDP was fed.

**Key Words:** Spray-dried plasma, Broiler, Performance

**M13 Effect of pelleting and expander conditioning temperatures on performance of broilers fed pellets containing spray-dried plasma.** J. M. Campbell\*, J. D. Crenshaw<sup>1</sup>, L. E. Russell<sup>1</sup>, K. C. Behnke<sup>2</sup>, and P. M. Clark<sup>2</sup>, <sup>1</sup>APC, Inc., Ankeny, Iowa, <sup>2</sup>Kansas State University, Manhattan.

Two experiments evaluated the effects of mash conditioning temperature from a pellet mill or expander on performance of broilers fed pelleted diets containing spray-dried plasma (SDP). In experiment 1, Ross x Ross 308 male broilers were randomly assigned to one of five dietary feeding programs (6 broilers per pen and 8 pens per treatment). Corn-soybean meal based dietary treatments were fed from d 0 to 21 and were formulated to be equal in lysine and metabolizable energy. All diets were conditioned for 15 seconds at 85°C then pelleted through a 4 mm x 32 mm die. Dietary treatments were control (0% SDP); SDP (1.0%) applied post-pelleting and SDP (1.0%) mixed into the mash and then pelleted at 85, 90, or 95°C. Experiment 2 was designed similarly to Exp. 1, with the exception that 10 pens (6 broilers per pen) per treatment were used and experimental treatments were control (0% SDP) pellet or expanded and SDP (1.0%) applied into the mash and then pelleted or expanded. Pelleted diets were conditioned for 15 seconds at 85°C and expanded diets were conditioned at 95°C, 7.5 kilowatts/ton, 200 psi cone pressure, exit temperature of 149°C and then pelleted. In Exp. 1, ADG, feed intake, feed efficiency and body weight were improved ( $P < 0.01$ ) for broilers fed SDP from d 0 to 21 regardless of conditioning temperature. In Exp. 2, broilers fed SDP had improved ( $P < 0.05$ ) gain, body weight and feed intake regardless of processing method. Overall, results of both experiments indicated that mash pellet conditioning temperature from 85 to 95°C and expanded to 149°C does not impair the positive growth effects of SDP in pelleted or expanded broiler feed.

**Key Words:** Spray-dried plasma, Broiler, Mash conditioning temperature

**M14 Effects of eggshell 49 supplementation to laying hen diets containing different levels of calcium on performance and egg quality.** L. Tucker<sup>1</sup>, L. Nolle<sup>1</sup>, and H. Sener<sup>2</sup>, <sup>1</sup>Alltech Biotechnology Centre, Dunboyne, Meath, Ireland, <sup>2</sup>Alltech Turkey, Izmir, Turkey.

The mineral nutrition of laying hens is of paramount importance as it dictates the quality of eggshell as well as the longevity and production efficiency of the hen. Previous trials have shown that supplementing laying hen diets with organic minerals can improve shell quality and egg production parameters. Particular problems in shell quality are seen in older laying hens, whose mineral requirements can be higher compared to hens approaching peak production, due to erosion of body mineral reserves. The following trial was performed to evaluate the effects of diets formulated with either 3.5% or 4% calcium supplemented with a combined organic mineral product formulated for layers, Eggshell 49 (Alltech Inc, USA), containing organic manganese and zinc sources. Ninety-six, 62 weeks old Nick chick white laying hens were used in the experiment. Hens were divided into three groups with four cage replicates for the negative control and three for the experimental groups, each cage replicate containing 32 hens. The negative control diet was formulated with 3.5% Ca, the positive control provided 4% Ca, and the treatment diet was formulated with 3.5% Ca+1g/kg Eggshell 49. The experimental diets were fed during from 62-72 weeks of egg production. Parameters measured included laying performance and egg quality. Data were analysed by ANOVA. Results showed that eggshell thickness was significantly increased ( $p < 0.01$ ) and cracked egg ratio significantly decreased ( $p < 0.01$ ) in groups receiving Eggshell 49 or the positive control diet. No adverse effects were observed in any performance parameters. It was concluded that organic mineral supplementation of the diet of laying hens, during the late laying period, reduced cracked egg ratio and increased egg shell quality to the same level as 4% Ca diets, without any adverse effect on performance.

**Key Words:** Eggshell 49, Organic minerals, Egg quality

**M15 Responses to antibiotic growth promoters, mannanoligosaccharides and organic acids in Salmonella-challenged broilers.** M. Lodzi<sup>1</sup>, A. Malaguido<sup>2</sup>, and A. Kocher<sup>3</sup>, <sup>1</sup>Universidade Estadual de Ponta Grossa, Brazil, <sup>2</sup>Alltech do Brasil, Curitiba, PR, Brasil, <sup>3</sup>Alltech Biotechnology Centre, Meath, Ireland.

This study aimed to compare the performance of broilers given antibiotic growth promoter (Flavomycin), mannanoligosaccharides (MOS) or a combination of MOS and organic acids in a Salmonella challenge environment. A total of 120 one-day old Roos male chicks were divided into 5 treatment groups with 4 replicates each and 6 birds/replicate. On day 4, birds were inoculated with a 1ml solution containing 1x10<sup>8</sup> CFU/ml Salmonella enteritidis, according to the following treatments: T1) no inoculation, basal diet without additives; T2) Salmonella inoculation basal diet without additives; T3) Salmonella inoculation, basal diet + AGP (flavomycin - 8 ppm (85%)); T4) Salmonella inoculation, basal diet + MOS (Bio-Mos, Alltech Inc. ) (1 kg/ton 0-21d and 0.5 kg/ton 22-35d); and T5) Salmonella inoculation, basal diet + MOS (1 kg/ton 0-21d) + MOS/organic acids (0.5 MOS+1kg/t organic acids 22 to 35 days). Weight gain, feed consumption and feed conversion rate were measured weekly, while mortality rates were measured daily. Data were subjected to ANOVA (SAS Institute Inc., 1993) and the means were compared by Tukey test. Salmonella inoculation significantly affected final bodyweight (BW) at 35d of age. Birds fed diets with AGP had significantly higher feed intake and FCR compared to birds fed MOS or MOS+organic acids. However there were no differences between AGP or MOS. The inoculation with Salmonella had no impact on overall mortality. Based on the results of this study it appears that the reduction in broiler growth performance as a result of a sub-clinical Salmonella infection could be overcome by adding MOS or MOS in combination with organic acid to the diet.

#### Performance of broilers from 1 to 35 days of age

| Treatment               | Bodyweight g | Feed intake g | FCR   | Mortality % |
|-------------------------|--------------|---------------|-------|-------------|
| unchallenged control    | 1454         | 2122          | 2.103 | 6.5         |
| challenged control (CC) | 1769         | 2264          | 1.888 | 6.5         |
| CC+AGP                  | 1593         | 2623          | 2.310 | 6.8         |
| CC+MOS                  | 1651         | 2010          | 1.789 | 6.5         |
| CC+MOS+Acid             | 1753         | 2171          | 1.752 | 6.1         |
| CV%                     | 5.84         | 12.02         | 8.59  | 10.9        |
| P-value                 | 0.01         | 0.05          | 0.01  | NS          |

1 Mortality percentage was  $(x+1/100)^{0.5}$  transformed before ANOVA

**Key Words:** Salmonella, Mannanoligosaccharides, Bio-Mos

**M16 The effect of phytase enzyme on early egg production and egg quality of laying hens.** A. S. Hussein\*, United Arab Emirates University, Alain, United Arab Emirates.

A study on the effect of commercial phytase enzyme supplementation on early egg production and egg quality of laying hens fed corn-soybean based layer diets containing different levels of phytase enzyme (phyzyme-500G) was carried out. Five replicate groups of twenty commercial Lohmann LSL-White layers, eighteen wk of age, were randomly assigned to each of two dietary treatments. The trial was conducted for twenty weeks. The diets were isonitrogenous (16.0% CP) and isocaloric (2800 Kcal/Kg). The control diet was a corn-soybean layer diet containing 3.65% Ca and 0.45% available P without added phytase enzyme. The treatment (low-phosphorus) diet was also a corn-soybean based layer diet containing 3.65% Ca and 0.22% available P with 500 PPU/Kg added phytase units. Average body weight and feed intake were measured periodically (every 4 weeks). Hen-day egg production and egg weight were determined daily and calculated periodically (every 4 weeks). Haugh unit scores, eggshell thickness and eggshell weight were measured and pooled from eggs collected during the last consecutive three days of each 4-wk period. The results showed that average body weight and feed intake of the laying hens were not significantly different in either treatment at 22 and 26 wk of age. Also, the average hen-day egg production (74.4 vs. 73.5%), egg weight (53.1 vs. 52.5g), Haugh unit scores (85.6 vs. 87.8) and eggshell thickness (0.446 vs. 0.448 mm)

were not significantly different in hens fed the control diet compared with those fed the low-phosphorus diet with the phytase enzyme during the first 8 weeks of egg production. The earlier results (first 8 weeks of production) showed that there was no significant difference between treatments in regard to egg production performance because either the low-phosphorus level was adequate by itself for these parameters or the phytase enzyme compensated for the low-phosphorus level.

**Key Words:** Phytase, Egg quality, Layers

**M17 Apparent metabolizable energy of diets based on wheat, sorghum or corn for the newly hatched broiler chick.** D. V. Thomas and V. Ravindran\*, Massey University, Palmerston North, New Zealand.

Studies on the changes with age in the apparent metabolizable energy (AME) in the young broiler chick are limited. The present study was undertaken to determine the AME of diets based on wheat, sorghum and corn during the first two weeks post-hatch of broilers. Three experimental diets containing wheat, sorghum and corn as the cereal base were formulated. All three diets were formulated to contain similar levels of energy and amino acids. The wheat-based diet was supplemented with a commercial xylanase. Each diet was fed to six replicate groups (8 birds/replicate) from days 1 to 14 post-hatching. On days 3, 5, 7, 9 and 14, classical total excreta collection method was employed to determine the AME values of the diets. The AME of the wheat-based diet on days 3, 5, 7, 9 and 14 were determined to be 3585, 3135, 2850, 3155 and 3380 kcal/kg DM, respectively. The corresponding values for the sorghum-based diet and corn-based diet were 3705, 3260, 3095, 3430 and 3410; and 3585, 3245, 3160, 3370 and 3320 kcal/kg DM, respectively. Repeated measures analysis revealed significant diet ( $P < 0.05$ ) and time ( $P < 0.001$ ) effects. A significant diet x time interaction ( $P < 0.05$ ) was also observed, indicating that the diet effects were dependent on the age of the chick. The AME of all three diets were high on day 3, decreased on day 5, reached the lowest value on day 7 and increased thereafter. The decrease in AME from day 3 to day 7 was greatest for the wheat-based diet. The AME of the three diets were similar on days 3, 5 and 14, but differed on days 7 and 9. The AME of wheat-based diet was lower than those of the other two diets on days 7 and 9. The significance of and causes for the drop in AME observed from day 3 to day 7 post-hatching are unclear. These observations are interesting and it is tempting to speculate that amelioration of this decrease by dietary manipulations, such as enzyme supplementation, may improve subsequent performance of broilers.

**Key Words:** Apparent metabolizable energy, Cereal type, Broiler chicks

**M18 Performance and carcass yield of broilers fed with diets supplemented or not with antibiotic and anticoccidial drugs.** M. B. Cafe\*, C. P. Cruz, A. S. C. Oliveira, J. H. Stringhini, M. A. Andrade, and L. S. Chaves, Escola de Veterinaria - Universidade Federal de Goias, Goiania, Goias, Brazil.

A 2 X 2 factorial experiment was conducted to determine the effects of diet supplementation or not of the antibiotics (Zinc Bacitracin and Olaquidox) and anticoccidial (Nicarbazin and Monenzin) drugs. A total of 1008 Ross chicks were placed into a 16 floor pens with 63 birds divided in four treatments: T1) Diets with antibiotic and with anticoccidial; T2) Diets without antibiotic and without anticoccidial; T3) Diets with antibiotic and without anticoccidial and T4) Diets without antibiotic and with anticoccidial. The birds were raised with recycled litter until 45 days old. The performance of the birds was evaluated once a week. At the end of experiment (45 days), twenty birds by treatment were slaughtered and the carcass yield was measured. The standard randomized factorial scheme (ANOVA) statistical model was used to analyze the data. The average of the initial weight of the birds was 44.1 grams. At the end of 45 days, the results of the performance of the birds showed no statistical differences among the treatments. The carcass results showed that the carcass yield of the treatments with antibiotics were worse (81.79%) than the treatments without antibiotics (82.29%).

**Key Words:** Antibiotic, Anticoccidial, Broiler

**M19 Effects of source of fat and fiber level on productive performance in broiler from 1 to 21 d of age.** A. González-Serrano, J. M. González-Alvarado, R. Lázaro, and G. G. Mateos\*, *Universidad Politécnica de Madrid, Madrid, Spain.*

An experiment was conducted to study the influence of type of fat and inclusion of crude fiber in the diet on productive performance of broilers from 1 to 21 d of age. The experimental design was completely randomized with six treatments arranged factorially with two sources of fat [5% vegetable oil with 53.9% linoleic acid (VO) and 5% yellow grease with 23.8% linoleic acid (YG)] and three sources of fiber (none, 3% oat hulls and 3% sugar beet pulp). Each treatment was replicated six times (a cage with 18 broilers). The control diets were formulated to contain 1.5% crude fiber and were based on rice (58%), soy protein concentrate (22%), fish meal (7%), fat (5%), and an inert material (3%). In the remaining diets, the corresponding fiber source was included at expenses of the inert material. No interactions between main effects were found for any trait throughout the experiment and therefore, only main effects are studied. From 0 to 5 d of age type of fat did not influence any of the traits studied. However, broilers fed the high-fiber containing diets grew faster (14.0 vs 13.2 g/d;  $P < 0.001$ ) and tended to have better feed to gain ratio (1.052 vs 1.117 g/g;  $P < 0.10$ ) than broilers fed the low-fiber containing diets. Also, broilers fed oat hulls grew faster than broilers fed sugar beet pulp (14.2 vs 13.7 g/d;  $P < 0.05$ ). Similar results were observed from 5 to 21 d of age. From 0 to 21 d of age broilers fed diets based on YG had better daily gains ( $P < 0.05$ ) but similar feed to gain ratio than broilers fed diets based on VO. Also, broilers fed the high-fiber containing diets had better daily gains (32.7 vs 31.2 g/d;  $P < 0.05$ ) and feed to gain ratio (1.319 vs 1.380 g/g;  $P < 0.001$ ) than broilers fed the low-fiber containing diets. The inclusion of a fiber source in a low-fiber diet improved productive performance at all ages. Therefore, chicks from 1 to 21 d of age might have a minimum requirement for fiber in the diet.

**Key Words:** Crude fiber, Broilers, Productive performance

**M20 Effects of phytase supplementation to diets with reduced available phosphorus content on performance and carcass traits of broilers.** M. Argüelles\*, H. L. Santiago, and A. A. Rodríguez, *University of Puerto Rico, Mayagüez, Puerto Rico.*

An experiment was conducted to determine the effects of graded levels of phytase supplementation to diets with modified available phosphorus (AP) contents relative to NRC requirements on performance and carcass traits. Ten dietary treatments consisted of: a control (NRC AP), and 9 diets with a factorial arrangement combining 300, 600, and 900 FTU/kg feed of phytase and AP reductions of .05, .10, and .15% from NRC requirements in each of the starter (1-21 d), grower (22-35 d), and finisher (36-49 d) diets. Six hundred chicks were assigned to 40 floor pens with four replicate pens per treatment. Bodyweight (BW), feed intake (FI), BW gain (BWG), and feed conversion (FC) was determined. At 49 d, a total of 200 birds were processed and carcass traits recorded. No significant differences in FI were observed among treatments. Nor were differences in BWG observed up to 35 d. During the finisher phase, control birds had similar BWG to that of all chicks supplemented with phytase combined. However, birds fed diets containing 300 and 900 FTU/kg had higher BWG than those fed diets with 600 FTU/kg. Broilers of all treatments had similar BW in the starter and finisher phases. However, in the growing period birds fed diets containing a .05% AP reduction and 300 FTU/kg of phytase were significantly heavier than birds fed diets with 300 and 600 FTU/kg and a .15 and .10% AP reduction, respectively. From 22 to 35 d, broilers fed diets with reductions of .05 and .10% AP and 600 FTU/kg had significantly better FC than the controls. Whereas from 36 to 49 d, birds receiving diets with a .10% AP reduction and 900 FTU/kg had better FC than controls. No differences among treatments were observed in the weight and percentage yield of major cuts and excised muscles. Carcass yield (CY) was significantly higher in birds fed diets with a .10% AP reduction and 600 FTU/kg than in those under the .15% AP reduction and 300 FTU/kg treatment. The results suggest that inclusion of phytase in the diet at levels of 600 and 900 FTU/kg has a positive effect on variables such as FC and CY, in combination with below recommended levels of AP.

**Key Words:** Phytase, Phosphorus, Broilers

**M21 Effects of phytase supplementation to diets with reduced available phosphorus content on tibia ash and mineral excretion of broilers.** H. L. Santiago\*, M. Argüelles, and A. A. Rodríguez, *University of Puerto Rico - Mayagüez Campus, Mayagüez, Puerto Rico.*

An experiment was conducted to evaluate the effects of supplementation of phytase to broiler diets with available P (AP) levels reduced below NRC requirements on tibia ash and mineral excretion. Treatments consisted of a control diet formulated to contain .45, .40, and .35% AP for the periods of 1 - 21 d, 22 - 35 d, and 36 - 49 d, respectively, and diets with the AP reduced by .05, .10 and .15% from that of the control with the addition of 300, 600, and 900 FTU/kg feed of phytase in each of the phases of growth. A total of 600 chicks were randomly distributed to 40 floor pens with 4 replicate pens of 16 birds. At 21, 28, 35, 42, and 49 d, two birds per replicate pen were wing banded and placed in stainless steel metabolic cages and used for determination of mineral excretion. Total fecal output was collected for 72 h from 3 to 7 wk of age and analyzed for total content of P, Ca, Mn, and Zn. At 49 d, a total of 200 birds were processed and the right tibia were excised and used for bone ash determination. Tibia ash content was similar for all treatments imposed, averaging 36.2%. Fecal P excretion was significantly greater in birds fed control diets than those fed diets with reduced AP and supplemented with phytase. However, P excretion was observed to decrease significantly in a linear fashion as AP decreased regardless of phytase level. No differences in total fecal content of Ca, Mn, and Zn were observed among treatments. There was a significant and concomitant increase in Ca excretion as the dietary AP decreased, which can be attributed to increases in the Ca:P ratio resulting from the reduction in dietary AP. There was a significant quartic response in excretion of all minerals with age, remaining constant from 21 to 35 d, peak at 42 d, and was lowest at 49 d of age. This apparent age effect could be partially attributed to changes in environmental temperature during the time of the study. These data suggest that diets formulated to contain .15% AP less than NRC recommendations and with addition of 300 FTU/kg feed of phytase significantly reduce mineral excretion without compromising bone integrity.

**Key Words:** Broilers, Mineral, Phytase

**M22 Effect of organic trace mineral on performance, carcass quality and physiological parameters in broilers.** A. G. Bertechini\*, R. K. Kato, A. Geraldo, E. J. Fassani, J. A. Brito, and G. O. Figueiredo, *Universidade Federal de Lavras, Lavras, Minas Gerais, Brazil.*

The aim of this experiment was to evaluate the replacement of trace mineral from inorganic to organic form. A total of 1440 one day-old male cobb 500 were randomly divided into one of the following treatments : T1= 100/0, T2= 80/20, T3= 60/40, T4=40/60, T5= 20/80 and T6=100/0 to inorganic/organic trace mineral ratio supplement in the diet, with 8 replicates. The mineral trace supplementation was : Zn=60, Mn=70, Fe=80, I=1, Se=0,3 and Cu=10 ppm for both inorganic and organic form. A corn-soy base diet and feeding program with two diets (1 to 21 and 22 to 41 days of age) were used. The performance, carcass quality and physiological parameters were evaluated. The color breast meat was evaluated with a Minolta Chroma Meter CR-300, with five readings per sample. The performance, carcass yield and lighter breast meat color were not affected by the replacement of inorganic to organic mineral trace at 41 of age. On the other hand, the increased proportion use of organic source, results in an increase breast meat yield, decreased glycolytic cells of breast, increased red color and decreased yellow color in the breast meat, and decreased of the hematocrit. The comparison between 100 % inorganic (T1) and 100% organic(T6) were significantly different for these parameters tested: 24.4 vs 26.1%(breast meat yield), 79 vs 74% (glycolytic cells of breast meat), 4.45 vs 5.09 (red color of breast meat), 5.15 vs 4.01 (yellow color of breast meat) and 36.7 vs 32.4% (hematocrit). These data indicate that the use of organic source of trace mineral can affect the economic carcass characteristics.

**Key Words:** Trace mineral, Broiler performance, Breast meat yield

**M23 The effects of in ovo feeding of arginine and/or beta-hydroxy-beta-methylbutyrate (HMB) on glycogen metabolism and growth in turkey poults.** O. Foye\*<sup>1</sup>, P. Ferket<sup>1</sup>, and Z. Uni<sup>2</sup>, <sup>1</sup>North Carolina State University, Raleigh, <sup>2</sup>Hebrew University of Jerusalem, Rehovot, Israel.

In ovo feeding (IOF), administration of nutrients into the amnion prior to pipping, may enhance early growth by enhancing hepatic gluconeogenesis and glycogen status. The effect of IOF arginine (ARG), HMB on bodyweights (BW), organ weights, total liver and pectoralis muscle (PM) glycogen of Hybrid™ poults were studied. At 23 d of incubation, 4 IOF treatment groups of 100 eggs were subjected to a factorial arrangement of 2 levels of ARG (0% or 0.7%) and 2 levels of HMB (0% and .1%) in 1.5 ml of .4% saline. Poults were provided feed and water ad libitum within 24 hours after hatch. BW were recorded and tissue samples were taken at 25 days of incubation (25E), hatch, 3, 7, and 14 d to determine PM yield, and hepatic glycogen content and glucose-6-phosphatase (G6P) activity. All in ovo fed poults had 3-4% greater BW than the non-injected controls (C) at hatch and the main effects of ARG and HMB responded independently ( $p < 0.05$ ). Three days post-hatch, the HMB and HMB + ARG-treated poults had 4.2% and 5.1% greater BW than C, respectively ( $p < 0.05$ ). At 10-d and 14-d, BW of poults in ovo fed HMB + ARG were 10.2% and 10.7% greater than C, respectively ( $p < 0.05$ ). At hatch, poults in ovo fed ARG, HMB and ARG + HMB had an 84%, 78.7%, and 75% greater total hepatic glycogen than C ( $p < 0.05$ ), and they had significant greater hepatic G6P ( $p < 0.05$ ). There was a significant ARG X HMB interaction at hatch on hepatic glycogen (total (mg), mg/g) and G6P activity ( $p < 0.05$ ). This study demonstrates that administration of HMB and ARG in ovo independently enhances hepatic glycogen reserves, which may provide the fuel needed for more rapid subsequent growth during the critical post-hatch period.

**Key Words:** In ovo feeding, Glycogen, Turkey

**M24 Effect of dietary nitrogen intake on broiler hepatic Spot 14 mRNA expression.** M. Hidalgo\* and A. Davis, *The University of Georgia, Athens.*

Spot 14 is a protein transcriptional factor that regulates the expression of several lipogenic enzymes. Our laboratory previously reported that as dietary protein concentrations increased broiler hepatic mRNA expression of Spot 14 decreased. In the present research, we investigated if dietary supplements of specific groups of amino acids or non-protein nitrogen sources could alter hepatic Spot 14 mRNA expression. One wk old broiler chicks were fed a semipurified isolated soy protein based basal diet containing 22% protein for a period of 4 d. Birds were then split into 4 groups of 6 replicate pens of 2 birds each. One group of birds was maintained on the basal diet while another group was fed a high (40%) protein diet. The other two groups received the basal diet supplemented with either the individual essential amino acids or the individual non-essential amino acids to equal the total amount found in the high protein diet (Exp. 1) or the basal diet supplemented with 6% alanine or 7.5% diammonium citrate (Exp. 2) or the basal diet supplemented with 5.1% ammonium bicarbonate or 4.25% ammonium phosphate. Each of the individual amino acid or non-protein nitrogen sources contributed half of the difference in the total amount of dietary nitrogen between the basal and high protein diets. After feeding the diets for 24 h, liver samples were collected for RNA extraction. Northern blot analysis was conducted with a chicken cDNA probe of Spot 14. Birds fed any of the supplemented diets or the high protein diet had significantly lower hepatic Spot 14 mRNA expression than birds fed the basal diet. The results suggest that the previously reported decrease in hepatic malic enzyme mRNA expression in the birds fed the high protein and the amino acid or nonprotein nitrogen supplemented diets was related to corresponding changes in Spot 14 mRNA expression. The results also suggest that supplementing protein adequate broiler diets with any source of dietary nitrogen could reduce body fat content, since a reduction in Spot 14 will result in lower activities of key lipogenic enzymes.

**Key Words:** Spot 14, Broiler, Dietary nitrogen

**M25 Impact of dietary amino acid density on broilers grown to small bird market.** A. Corzo\*<sup>1</sup>, M. T. Kidd<sup>1</sup>, W. A. Dozier<sup>2</sup>, T. J. Walsh<sup>3</sup>, and S. D. Peak<sup>3</sup>, <sup>1</sup>Mississippi State University, Mississippi State, <sup>2</sup>USDA-ARS, Poultry Research Unit, Mississippi State, Mississippi, <sup>3</sup>Novus International, St. Louis, Missouri.

A factorial study evaluated the effect of feeding high (H) or low (L) amino acid density diets during the pre-starter period and continued effect throughout the growing period, on Ross x Cobb broilers reared to 5 wk of age. Each treatment (2 gender x 5 diets) was replicated 9 times (12 broilers/pen). Diets were fed during four phases (0-7, 7-20, 20-28, 28-35 d), resulting in the 5 dietary treatments: HHHH, HHHL, HHLL, HLLL, LLLL. As an example, the treatment HLLL was given H diet during the pre-starter phase (0-7 d) and L diets during subsequent phases. The L diet fed from 0-7 and 7-20 d in the LLLL treatment was the same to mimic current industry practice. BW, feed conversion (FCR), and mortality were determined at the end of each feeding phase; and carcass traits at 35 d of age. Pre-starter and starter feeds were offered in crumbled form and subsequent diets in pellet form. Feed and water were provided ad-libitum. FCR was corrected for mortality. Birds fed a H pre-starter diet had improved ( $P > 0.01$ ) FCR and lower feed intake values than those fed L diets. At 20 d of age, birds fed HH diets had improved ( $P > 0.01$ ) FCR values vs those fed HL or LL diets. BW were heavier ( $P > 0.05$ ) at d 28 in birds fed HHH diets compared to those fed HHL and LLL, while HLL had intermediate values. Further, HHH fed birds had improved ( $P > 0.01$ ) FCR values when compared to HHL, HLL and LLL fed birds. Final feed intake and FCR was lower ( $P > 0.01$ ) in birds fed the HHHH diets compared to all other treatments. Carcasses from birds fed LLLL had higher ( $P > 0.01$ ) weight and percentage abdominal fat than those fed H diets to d 20. No effect of diet density was observed for carcass or breast meat yield. Throughout the study, males had higher ( $P > 0.01$ ) BW and feed intake, and lower FCR than females. Females had higher ( $P > 0.01$ ) relative values of abdominal fat. Males had higher ( $P > 0.01$ ) breast meat weight and yield than females. Broilers fed H amino acid density diets improved FCR. Lack of an effect of diet on BW and carcass traits may be attributable to the strain used and should be considered when comparing results to previous amino acid density studies.

**Key Words:** Amino acid, Broiler, Carcass

**M26 Incorporation of an E. Coli phytase in broiler diets: Effect on growth and processing parameters.** P. Pillai\*, J. Mehaffey, C. Owens, and J. Emmert, *University of Arkansas, Fayetteville.*

The objective of this experiment was to evaluate the effect of an E. Coli phytase (ECP) on broiler growth performance, carcass yield, and bone breakage during processing. Broilers were reared in a four-phase grow-out pattern from 1-50 d and fed four corn-soybean meal diets containing 0.35 or 0.45% non-phytate P (Pi) in the presence or absence of 300 FTU/kg ECP. Two additional treatments consisted of corn-soybean meal diets containing 0.30% Pi with 600 FTU/kg ECP, and 0.25% Pi with 1,000 FTU/kg ECP. Each of the six dietary treatments was replicated in seven floor pens containing 20 chicks per pen. Growth parameters were recorded during the starter (1-18 d), grower (18-32 d), finisher (32-40 d) and withdrawal (40-50 d) periods. With the exception of the withdrawal period, weight gain of broilers receiving the low-Pi diet without ECP was reduced ( $P < 0.05$ ); addition of ECP prevented reduced growth performance. On d 50, five birds per replicate were processed and carcass yield, parts yield and incidence of bone breakage (during processing) were recorded. Tibia ash content was also determined. Carcass, breast, wing, and leg yield were not affected ( $P > 0.05$ ) by dietary Pi level or by the presence of ECP. Similarly, the incidence of wing disjoints and clavicle, coracoid, and tibia breakage during processing were not affected ( $P > 0.05$ ) by dietary Pi level or by the presence of ECP. Relative to the Pi-adequate control, incidence of wing breakage during processing was not increased ( $P > 0.05$ ) in diets containing lower Pi levels and ECP. Relative to the Pi-adequate control, tibia ash (%) was reduced ( $P < 0.05$ ) in birds fed 0.35% Pi; addition of ECP to diets containing low Pi prevented a reduction in tibia ash (%) compared to the Pi-adequate control. The data suggest that ECP effectively prevents reduced growth performance, carcass yield, and processing defects in broilers fed diets containing as little as 0.25% Pi from 0-50 d of age.

**Key Words:** Broiler, Phytase, Processing

**M27 Effect of gelatinizing dietary starch through feed processing on 0-to-3-week broiler performance and metabolism.** J. S. Moritz<sup>\*1</sup>, A. S. Parsons<sup>1</sup>, N. P. Buchanan<sup>1</sup>, W. B. Calvalcanti<sup>2</sup>, K. R. Cramer<sup>2</sup>, and R. S. Beyer<sup>2</sup>, <sup>1</sup>West Virginia University, Morgantown, <sup>2</sup>Kansas State University, Manhattan.

Feed manufacturing produces physical and chemical changes in ingredients, including the gelatinization of starch. The effect of gelatinized starch on animal metabolism and subsequent performance has been inconsistent in past research. In the current study, corn was manufactured through different processes (pelletting and extrusion) and substituted for unprocessed corn at varying levels (1/3, 2/3 and 3/3) in complete diets. Complete diets were not further processed. The objective of the study was to evaluate different levels of starch gelatinization produced by different processes on broiler performance through 3 wk of age. Pelleted and extruded corn had analyzed starch gelatinization percentages of 29 and 92, respectively. Each of the six processed corn diets and a control diet (ground unprocessed corn) was fed to eight replicate pens of 10 male broilers. A second experiment was conducted that determined nitrogen corrected apparent metabolizable energy (AMEn) of each diet. Broilers fed diets containing pelleted corn had lower feed intake ( $P = 0.0439$ ) and higher gain to feed (G:F,  $P = 0.0028$ ) than broilers fed diets containing extruded corn. Gain to feed ratio was not affected when pelleted or extruded corn was increased in diets. Nitrogen corrected apparent metabolizable energy of diets increased as pelleted or extruded corn inclusion increased ( $P = 0.0331$  and  $0.0009$  respectively). Diets containing pelleted or extruded corn pooled by inclusion level did not improve AMEn or G:F compared to the control diet. However, diets containing pelleted or extruded corn pooled by inclusion level increased live weight gain (LWG,  $P = 0.04$  and  $0.0038$  respectively) compared to the control in part due to increased feed intake.

**Key Words:** Starch gelatinization, Broiler, Metabolism

**M28 The use of dual-Energy x-ray absorptiometry to evaluate the bone mineral status of laying hens during molting and reestablishment of lay.** N. P. Johnston<sup>\*</sup>, S. Fullmer, E. Maceda, R. T. Davidson, and A. L. Campbell, Brigham Young University, Provo, Utah.

Dual-Energy X-Ray Absorptiometry (DEXA) was investigated as a non invasive means of observing changes in bone mineral status associated with the forced molting of laying chickens. It was hypothesized that fasting and/or the feeding of low calcium feeds would have a marked effect on bone mineral integrity. To test the hypothesis, 15 producing SC White Leghorn chickens in the fifth month of lay were molted. The birds were fasted for one week during which time they lost 24.1% of their body weight. They continued to lay eggs for five days and at the onset the average egg specific gravity was 1.092 and moved rapidly downward to 1.060 when lay ceased. The following week the birds were fed only ground corn (0.05% Ca) during which time they recaptured a substantial portion of their lost weight. In the third week the hens were returned to a balanced feed containing 3.4% calcium. Egg laying began again during the 4th week. Weekly, the left tibia of each bird was scanned using DEXA. At the onset of the fast, the bone mineral content (BMC) and bone mineral density (BMD) were 2.8 g and 0.255 g/cm<sup>2</sup> respectively. As hypothesized, following the fast, the mineral content and density of the tibia decreased significantly ( $P < 0.05$ ) to 2.5 g and 0.219 g/cm<sup>2</sup>. An additional week on a low calcium diet affected the mineral status only marginally (2.4 g and 0.209 g/cm<sup>2</sup>). After the first week on complete feed the BMC and BMD were rapidly restored increasing significantly ( $P < 0.05$ ) to 2.7 g BMC and 0.233 g/cm<sup>2</sup> BMD and remained essentially the same after the second week on acceptable calcium levels with readings of 2.8 g BMC and 0.238 g/cm<sup>2</sup> BMD. It was interesting to note that during the fast, weight loss of tissue surrounding the tibia was lean and not fat resulting in a significant ( $P < 0.05$ ) increase in tissue fat. As evidenced by DEXA scans, bone mineral status is compromised rapidly during fasting but is quickly reestablished upon return to acceptable feed calcium levels.

**Key Words:** DEXA, Molt, Mineral

**M29 0-to-6 week broiler performance effects of bacitracin/3-nitro replacement in a cocci vaccination program.** A. Parsons<sup>\*1</sup>, A. McElroy<sup>1</sup>, T. Sefton<sup>2</sup>, and C. Novak<sup>1</sup>, <sup>1</sup>Virginia Tech, Blacksburg, <sup>2</sup>Alltech, Inc., Guelph, ON, Canada.

Research suggests that feeding broilers a diet containing Bio-MOS<sup>®</sup> and All-Lac XCL reduces the negative effects associated with feeding diets lacking growth promoters. The objective of the current study was to determine the performance effects of a Bacitracin/3-Nitro replacement in a cocci-vaccination program. Treatments consisted of a corn/soybean meal diet supplemented with AGP (bacitracin) +3-Nitro (ANT), Non antibiotic program (ANE) and a negative control (NC). Broilers fed the ANT and NC diets were vaccinated with CoccoVac at the hatchery, while those fed the ANE were vaccinated with a combination of All-Lac XCL 5X and CoccoVac. Each of the diets were fed to fourteen replicate pens of 45 straight-run Cobb broilers (0.8 sq ft/chick) during the (1-14d) starter, (14-28d) grower, (28-35d) finisher and (35-49d) withdrawal periods. Diets were formulated to meet or exceed NRC recommendations for each respective growth period and fed in mash form. No significant differences in live weight gain (LWG), feed intake (FI) or feed conversion (FC) were seen between broilers fed the ANT and NC diets ( $p > 0.05$ ). No differences in LWG ( $p > 0.05$ ) were seen between broilers fed (ANE program) and the NC diet. Broilers fed ANE diets had greater 1-49d FI than those fed ANT ( $p = 0.02$ ) and NC ( $p = 0.04$ ), 5.554, 5.411 and 5.427 kg, respectively. Broilers fed ANT ( $p = 0.0002$ ) and NC ( $p = 0.002$ ) showed improved 1-49d FC compared to those fed the ANE, 1.810, 1.820 and 1.868 kg/kg, respectively. Mortality was significantly affected during the grower period ( $p = 0.004$ ). Mortality was greater for broilers fed the NC and ANE when compared to those fed the ANT diet,  $p = 0.0074$  and  $p = 0.0017$ , respectively. These findings conclude that replacing ANT in a combination with cocci vaccine negatively affects overall broiler growth and FC and positively affects incidence of mortality during the 14-28d period. In the absence of coccidia, research suggests that replacing Bacitracin/3-Nitro with Bio-MOS<sup>®</sup> positively affects broiler performance during the 14-28d period.

**Key Words:** Broiler performance, 3-Nitro, Bio-MOS

**M30 The effects of source and level of dietary copper on copper and zinc metabolism in broiler chicks.** J. L. Pierce<sup>\*</sup>, A. J. Pescatore, M. J. Ford, and A. H. Cantor, Alltech-University of Kentucky Nutrition Research Alliance, Lexington.

Effects of dietary copper (Cu) source and level were evaluated using seven dietary treatments. Six birds were allocated to each of nine replicates per treatment based on weight at 7 days of age. The birds were housed in cages in an environmentally controlled building. Diets were fed from 7 to 21 days. Sources of Cu were Cu sulfate and chelated Cu (Bioplex<sup>™</sup>, Alltech, Nicholasville, KY). All diets contained 75 ppm added Zn from Zn sulfate. Cu sources were added to a basal diet (Trt 1): Cu sulfate at the levels of 62.5 ppm (Trt 2), 125 ppm (Trt 3), 250 ppm (Trt 4); Bioplex Cu at 25 ppm (Trt 5), 50 ppm (Trt 6), 100 ppm (Trt 7) dietary Cu. Cu content of the basal diet was 20 ppm. Feed consumption was depressed ( $P < 0.05$ ) by the high level of Cu sulfate (Trt 4), resulting in an 18 g reduction in body weight. Body weight and feed consumption were not significantly different for the other treatments. Source or level of Cu did not affect feed conversion. Liver Cu levels were elevated with the high level of Cu sulfate. Excreta were collected for 14 days from two replicates per treatment. There was a linear increase in excreta Cu content as dietary Cu level increased. Cu retention decreased as the levels of Cu sulfate increased; conversely, retention of Cu from Bioplex Cu increased linearly as dietary levels increased and were on average 35% higher in the birds fed Bioplex Cu ( $P < 0.01$ ). Zinc (Zn) retention was reduced as Cu sulfate levels increased and Zn retention was higher ( $P < 0.03$ ) for birds fed Bioplex Cu. Liver Zn content was depressed with the highest level of Cu from Cu sulfate, however liver Zn was maintained with all levels of Bioplex Cu. These data suggest that using Bioplex Cu may reduce Cu-Zn antagonisms and increase the retention of both minerals.

**Key Words:** Copper, Zinc, Retention

**M31 Increases in feathermeal digestibility by the proteinases produced by *Bacillus Subtilis* var. Natto.** P. Herrera, W. Kim\*, and S. Ricke, *Texas A&M University, College Station.*

In broiler production, over 10<sup>6</sup> tons of feathers are generated annually. Made primarily of keratin, feathermeal is over 75% crude protein by weight. It has been used as a minor nitrogen source in the feeding of ruminants. However it is largely indigestible by non-ruminants and poultry due to the extensive cross-linking of cystine. Increasing the digestibility of feathermeal would enhance its use as an inexpensive source of protein. The bacterium *Bacillus Subtilis* var. Natto (BSN) is used in Japan to ferment soybeans to create the traditional food natto. BSN produces proteinases during fermentation that increases the digestibility of soybeans. This research is to characterize and maximize BSN ability to increase the digestibility of feathermeal. Previous work has determined that the optimal conditions for producing natto involved autoclaving soybean meal (100g) for 15 m at 121°C, inoculating with 10<sup>5</sup> CFU of BSN, and incubated for 18 h. A mixture of equal parts feather and soybean meal (100g) was soaked in 400 ml PBS for 1 h, after which the unabsorbed liquid was drained. The mixture was autoclaved, inoculated with BSN, and incubated at 45°C for 36 h. Periodically, samples were removed for testing. Changes in digestibility were determined by suspending dried samples in 0.15 M saline and measuring increases in dry matter solubility and soluble protein content. Protein solubility was determined by the Lowry method. Digestible protein content increased 66% over the 36 h incubation period, from an initial 420 µg/ml at the start, to 604 µg/ml at 18 h, and finally to 700 µg/ml at 36 h.

**Key Words:** Feathermeal, *Bacillus Subtilis*, Digestible Protein

**M32 Nutritional means to lower trace mineral excretion from poultry without compromising performance.** J. L. Pierce\*, B. L. Shafer, R. Power, and K. A. Dawson, *Alltech-University of Kentucky Nutrition Research Alliance, Lexington.*

To evaluate the effects of reduced dietary trace mineral levels on growth and mineral excretion of broiler chickens, 246 Cobb × Cobb males were used in a randomized completed block design. Seven replicates of birds were blocked by room position and exposed to continuous lighting. There were seven dietary treatments. Treatments 1-3 contained a premix that provided 100, 50, and 25%, respectively of NRC (1994) requirements for Cu, Zn, and Fe supplied by sulfates. The NRC (1994) states the requirements for broilers from 1-3 weeks of age are 5 ppm Cu, 100 ppm Zn, and 30 ppm Fe. Treatments 4-6 contained a premix that contained 100, 50, and 25%, respectively, of NRC (1994) requirements for Cu, Zn, and Fe supplied by Bioplex™ organic minerals. Treatment 7 served as a negative control with no added trace mineral premix. Birds were housed in 35 × 54 cm cages with *ad libitum* access to feed and water. The experimental duration was 14 d. Birds and feed were weighed at the beginning and end of the experiment to determine ADG, ADFI, and FE. On d 9-10 total excreta was collected to determine mineral content and retention. Data were analyzed as a randomized complete block design with pen serving as the experimental unit. There was a linear (P<0.01) decrease in gain and feed intake for birds fed decreasing levels of inorganic minerals. In contrast, growth performance and feed intake were maintained as mineral levels were decreased in the Bioplex™ treatments. Excreta Cu and Zn concentrations decreased linearly (P<0.01) as the dietary levels decreased regardless of source. These data suggest that only 25% of current NRC (1994) requirements for poultry may be needed for normal performance when fed as Bioplex™ minerals.

**Key Words:** Copper, Zinc, Broilers

**M33 Impact of Avizyme 1500 on apparent ileal amino acid digestibility in poultry.** J. C. Remus\*<sup>1</sup>, M. Hruby<sup>2</sup>, and E. E. M. Pierson<sup>1</sup>, <sup>1</sup>*Danisco Animal Nutrition, St. Louis, Missouri*, <sup>2</sup>*Danisco Animal Nutrition, Marlborough, Wilts, United Kingdom.*

The goal of this evaluation was to examine the impact of 0.1% Avizyme 1500 supplementation on digestibility of key amino acids in poultry diets. A number of scientific studies have shown that the enzyme product is effective in energy digestibility improvement with average responses of 90 kcal/kg feed (41 kcal/lb) and protein digestibility by about 3%. Apparent ileal amino acid digestibilities

were measured in 1 layer, 1 duck and 3 broiler trials conducted at ADAS in England, Purdue University and Stephen F. Austin State University in the US as well as Federal University of Vicosa and University of Sao Paulo in Brazil, respectively. All diets used in this evaluation were corn/soy based and met nutrient needs of the birds. Performance data from these trials have been presented previously. Statistical analyses of data from the broiler trials (10 mean observations/treatment) as well as all poultry trials (12 mean observations/treatment) were conducted using JMP software (SAS institute). Since each trial was conducted at a separate place, site was used as a covariate (significant at P<0.05 for amino acids shown). Treatments from each site consist of control and Avizyme 1500 means for lysine, methionine, cysteine and threonine digestibilities. The results indicate that Avizyme may improve digestibility of key amino acids, particularly those associated with intestinal secretions/endogenous protein.

**Average apparent ileal digestibilities coefficients across trials**

| Trial                  | Treatment             | Lysine | Methionine | Cysteine | Threonine |
|------------------------|-----------------------|--------|------------|----------|-----------|
| All Broiler (3 trials) | Avizyme               | 85.82  | 92.91      | 75.89    | 76.43     |
|                        | Control               | 84.96  | 92.76      | 74.44    | 74.87     |
|                        | Probability Model     | 0.014  | <0.0001    | 0.004    | <0.0001   |
|                        | Probability Treatment | 0.43   | 0.77       | 0.067    | 0.17      |
| All Poultry (5 trials) | Avizyme               | 87.11  | 93.37      | 79.95    | 79.17     |
|                        | Control               | 86.13  | 92.87      | 78.73    | 77.46     |
|                        | Probability Model     | 0.007  | <0.0001    | <0.0001  | <0.0001   |
|                        | Probability Treatment | 0.30   | 0.34       | 0.076    | 0.086     |

**Key Words:** Avizyme, Amino Acid, Digestibility

**M34 The effect of Avizyme 1502® on early poult performance from 0-21 days.** C. Troche\*<sup>1</sup>, X. Sun<sup>1</sup>, A. McElroy<sup>1</sup>, J. Remus<sup>2</sup>, and C. Novak<sup>1</sup>, <sup>1</sup>*Virginia Tech, Blacksburg*, <sup>2</sup>*Danisco Animal Nutrition, Carol Stream, Illinois.*

Studies performed with broilers have shown that some of the production increases with enzyme supplementation can be observed within the first 21 days of life due to digestive inefficiencies. Thus, a study was designed to determine the effects of enzyme supplementation on young turkey poults fed a commercially based diet which included; corn, soybean meal (SBM), meat and bone meal and ground wheat as protein sources. Day old BUTA turkey poults (n = 3850) were randomly divided into 35 pens and fed one of five dietary treatments for 21 days. Performance parameters (feed intake (FI), body weight gain (BWG), feed conversion (FCR) and mortality) were evaluated along with determination ileal digestibility of protein and energy on days 4, 8, 12, 16, 21. Dietary treatments consisted of: a positive control (PC), a negative control (NC) (corn matrix adjustment of 140 kcals - increase), and NC diets containing graded levels of Avizyme 1502® (250g/MT, 500g/MT or 750g/MT of complete diet). Mortality and FCR were not affected by enzyme supplementation. Body weight gain was significantly affected by treatment on days 4, 12, 16 and 21 (P<0.05), with enzyme supplemented poults gaining more than the PC at 16d and 21d. Body weight gain at 4 d was (P = 0.058) affected negatively with a linear decrease with enzyme inclusion (0.0415, 0.0400, 0.399 kg, respectively). Feed intake was also affected by diet at 4 and 21 d (P = 0.0871 and P = 0.058), with 21 d FI displaying a quadratic (P = 0.0118) affect with enzyme inclusion. There was no interaction of days of age and diet in regards to protein and energy ileal digestibilities. PC fed poults had greater (P < 0.05) ileal digestibility of energy and protein, compared to NC fed group w/wo enzyme. Also, eight day old poults had improved protein digestibility over 21d poults with other age groups falling within this range. Overall, Avizyme 1502® has a beneficial effect on performance to 21 days, but the benefit may come from another parameter other than nutrient digestibility.

**Key Words:** Avizyme 1502®, Turkey poults, Early nutrition

**M35 The effect of rearing programs on reproductive performance and carcass traits of ultra high yield type broiler breeder hens.** M. Beer\* and C. N. Coon, *The University of Arkansas, Fayetteville.*

An experiment was conducted to determine effects of 8 nutritional treatments during the rearing period on reproductive performance of ultra high yield broiler breeder hens. 1680 day old Cobb 700 breeder pullets were randomly assigned to 48, 8ft x 7ft floor pens. There were 6 replicate pens of 35 birds/treatment. Treatment 1 (control) was fed according to breeder recommended guidelines. Treatment 2 was fed the same diets but in smaller amounts to weigh approximately 0.2 lbs less at housing. Treatments 3 and 4 were the same as treatment 1 except they received starter (19% CP) for 5 and 6 weeks respectively, as opposed to 4 weeks for all other treatments. Treatments 5 and 6 were the same as treatment 2 but received high (17.25%) and low (14.25%) protein prebreeder, respectively. Treatments 7 and 8 were the same as treatment 1 but received high (17.25%) and low (14.25%) protein prebreeder, respectively. All groups gained more than 30% of their weight at housing during the 16 to 21 week period. Pullets were photostimulated at 21 weeks and housed individually in breeder cages. Feeding for all groups was identical after housing. Egg production was recorded daily and egg weights twice weekly. Hatchability was determined every 3 weeks from week 34. Shank and keel lengths were used to gauge frame size. At 47 weeks, breeders from treatments 3 and 4 had laid 4 and 5 more eggs/hen than the control group, respectively. Treatment 3 and 4 received more protein during weeks 5 or 6 but did not weigh more at housing than controls. Egg weights from treatments 2, 5 and 6 were lower ( $p < 0.05$ ) than other groups and positively correlated to a smaller frame size and body weight at housing. The treatment 5 breeders also required significantly ( $p < 0.05$ ) more days to first egg than other groups. Extra protein (10-20g total) during the 4-6 week period improved egg production whereas extra protein during the prebreeder phase did not improve egg production.

**Key Words:** Ultra high yield broiler breeders, Rearing programs, Egg production

**M36 Metabolizable energy value for corn distillers dried grains with solubles in turkey diets.** S. L. Noll\*<sup>1</sup>, J. Brannon<sup>1</sup>, J. L. Kalbfleisch<sup>2</sup>, and K. D. Roberson<sup>2</sup>, <sup>1</sup>*University of Minnesota, St. Paul,* <sup>2</sup>*Michigan State University, East Lansing.*

Reported ME for corn distillers dried grains with solubles (DDGS) varies considerably. A grow-finish trial was conducted with turkeys to confirm the appropriate energy value of DDGS to use in diet formulation. Commercial male turkeys (Large White, Hybrid strain) were fed diets varying in level of DDGS (10 or 20% DDGS) and formulated using different levels of MEN assigned to the DDGS during 6 to 19 wks of age. The ME assignments were (kcal/kg): previously determined TMEn in young growing turkeys of 2980; previously determined AMEn with young turkey poults of 2760; and, the NRC (1994) book value of 2480. The basal diet was composed of primarily corn, soybean meal, poultry byproduct meal and .05% supplemental thr. Diets were formulated on a digestible amino acid basis. A control diet with no DDGS was included. Each diet was fed to 10 replicate pens of turkeys (10 birds/pen). The higher inclusion level of 20% depressed body weight in comparison to the control ( $P < .01$ ) at 11 (7.95 vs. 7.85 kg), 14 (11.99 vs. 11.80 kg), and 19 wks of age (17.35 vs. 17.11 kg) while performance was similar for the control and 10% DDGS diet. The depression with a 20% inclusion level is in contrast to our previous data (Noll et al., 2004) that showed that a level of 20% gave similar performance to that of the control diet series. A reduction in diet protein level through the use of supplemental thr may have negatively affected the performance response. Cumulative 6-19 wk feed efficiency (f/g) was poorer for turkeys fed 20% DDGS diets in comparison to 10% DDGS (2.552 vs. 2.522) but neither dietary treatment was different from the control (2.53). Diets varying in E did not affect turkey body weight. When the TMEn value was used in formulation, cumulative 6-19 wk f/g was poorer as compared to the NRC value (2.56 vs. 2.52) ( $P < .05$ ). Determination of energy by TMEn resulted in an overestimation of the energy value of the DDGS when using feed efficiency as the response criteria. While there was no difference in response for the NRC or AMEn energy value, use of the lower NRC energy value could have a large effect on diet cost.

**Key Words:** Turkey, Metabolizable energy, Corn distillers dried grains with solubles

**M37 The crude protein and amino acid requirements for fertility and production for broiler breeders.** M. Beer\*, J. Sun, J. Lu, K. Bramwell, and C. N. Coon, *University of Arkansas, Fayetteville.*

Four hundred and eighty 32 week old Cobb-Vantress broiler breeders with similar body weight ( $3714 \pm 172$ g) and egg production were selected to determine the production and fertility requirement of dietary digestible methionine, lysine, phenylalanine, isoleucine, arginine, and CP in a 42 day feeding study. The breeders were given a corn-soy basal diet plus crystalline amino acids with 8 graded levels of methionine, lysine, phenylalanine, isoleucine, and arginine representing 40%~130% of highest suggested requirement between NRC (1994) and Fisher (1998). Glutamic acid was added to the basal diet containing 100% of essential amino acids to provide 80%~140% of suggested CP requirement (NRC, 1994). The breeders were fed 154g feed (467 kcal ME) daily. Each treatment contained ten birds. All breeders were inseminated weekly with 50 million sperm and eggs were set weekly for fertility measurements. Ninety five % of asymptote using regression analysis was utilized to determine requirements. The requirements of digestible methionine, lysine, arginine, phenylalanine, isoleucine and CP for g egg mass + g body weight change/d, g feed consumed/ g egg mass + body weight change/d and % fertility of hatching eggs were 408.7 mg/d, 436.2 mg/d, and 305.7 mg/d; 909.2 mg/d, 926.4 mg/d, and 371.1 mg/d; 1059.8 mg/d, 1032.8 mg/d, and 1034 mg/d; 689 mg/d, 699.8 mg/d, and 644.1 mg/d; 826 mg/d, 846.5 mg/d, and 378.1mg/d; and 20.9g/day, 19.3g/day, and 20.0g/day, respectively. The breeders fed 20 g/d of protein (13% CP) had an average fertility of 90.5 % compared to 82.7% for breeders fed 26g of protein (16%CP). The amino acid requirements for optimum fertility were lower for some amino acids compared to requirements for production and feed conversion. The breeders fed the lowest isoleucine (.23%) levels had the highest fertility (93.9%) of all breeder treatments and also the largest weight loss because the breeders only consumed 77% of daily feed.

**Key Words:** Digestible amino acids, Broiler breeders, Production

**M38 Effect of phytase addition in diets for broilers with several phosphorus levels.** F. J. Picón-Rubio<sup>1</sup>, J. R. Kaway Garza<sup>2</sup>, H. Fimbres Durazo<sup>1</sup>, J. L. Lazcano Villareal<sup>1</sup>, F. A. Santoyo\*<sup>1</sup>, and J. F. Garza<sup>2</sup>, <sup>1</sup>*Universidad Autónoma de Nuevo León, Monterrey, Nuevo León, México,* <sup>2</sup>*Universidad Autónoma de Nuevo León, Marín, Nuevo León, México.*

Phosphorus (P) is a mineral required by all domestic animals to meet its requirements. Phytase is an enzyme that liberates phosphate by hydrolysis from phytate, to make it more available for absorption in gastrointestinal tract of non-ruminant, like birds and pigs. Experimental diets with phosphorus and phytase were evaluated to estimate production parameters of broiler chickens and simultaneously to evaluate as a test of absorption, with phosphorus in diets. In experiment 1, feed intake, daily gain, and feed efficiency were measured in six treatment diets included three phosphorus levels (0, 50 and 100%) and two phytase levels (0 and 600 Units). Feed intake was increased by phytase ( $P < 0.01$ ) and phosphorus ( $P < 0.01$ ). Body weight gain was elevated by effect of phytase ( $P < 0.01$ ) and phosphorus ( $P < 0.01$ ); also an interaction and linear effect was seen ( $P < 0.01$ ). Phytase ( $P < 0.03$ ) and phosphorus influenced ( $P < 0.04$ ) on feed efficiency, and an interaction was also observed ( $P < 0.05$ ). In experiment 2, apparent phosphorus absorption, P intake was influenced by phosphorus level ( $P < 0.0001$ ) and phytase ( $P < 0.0001$ ), and an interaction was also observed ( $P < 0.0001$ ). Phosphorus excretions was also increased by P level ( $P < 0.01$ ) and phytase content ( $P < 0.0001$ ) in grams per day. Phosphorus retention was influenced by phosphorus ( $P < 0.0001$ ), phytase ( $P < 0.0001$ ) and their interactions ( $P < 0.003$ ). Phosphorus influenced ( $P < 0.04$ ) on percent tibia-bone ash, and by phytase ( $P < 0.003$ ). In content by percent of tibia phosphorus was increased by P level ( $P < 0.04$ ), although not by phytase ( $P > 0.05$ ) in diet.

**Key Words:** Broilers, Phytase, Phosphorus

**M39 Effect of dietary supplementation of organic minerals and phytase on mineral concentration in manure of brown egg laying replacement pullets.** A. Mañón, A. Cantor\*, A. Pescatore, M. Ford, H. Gillespie, and M. Daley, *Alltech-University of Kentucky Nutrition Research Alliance, Lexington.*

The effect of dietary supplementation of organic minerals (proteinates) and phytase on manure mineral concentration and growth performance was evalu-

ated in a study using 1152 Hy-Line Brown pullets, 2 wk of age. Corn-soybean meal starter, grower and finisher basal diets were fed with 1) no trace mineral supplement, 2) an inorganic trace mineral supplement or 3) an organic trace mineral supplement and with or without phytase in a 3 X 2 factorial arrangement of treatments. The levels of minerals (mg/kg diet) provided by the inorganic trace mineral supplement were: Cu (5), I (0.35), Fe (80), Mn (60) and Se (0.3) in the starter diets and Cu (4), I (0.35), Fe (60), Mn (30), Zn (35) and Se (0.3) in the grower and finisher diets. Mineral levels (mg/kg diet) provided by the organic trace mineral supplement were: Cu (1.8), I (3), Fe (9.6), Mn (16), and Se (0.2) in the starter diets and only half of these levels in the grower and finisher diets. Calcium and available phosphorus were both decreased by 0.1% in phytase supplemented diets. Twelve replicate groups of 16 pullets were assigned to each of the six treatments. The pullets were housed in cages in an environmental control building and fed experimental diets were fed from Weeks 3 through 18. Excreta samples were collected for 48 hr during Week 14 from eight replicates per treatment and analyzed for minerals content using induced coupled plasma spectrophotometry. Using organic minerals in place of inorganic minerals significantly ( $P < 0.05$ ) reduced manure concentrations of Cu (8 vs. 32 mg/kg dry matter), Fe (981 vs. 1552 mg/kg), Mn (80 vs. 246 mg/kg) and Zn (72 vs. 254 mg/kg). Compared with diets without enzyme supplementation, phytase decreased the levels of total P (35 vs. 40 g/kg), Ca (54 vs. 57 g/kg), Fe (1003 vs. 1357 mg/kg), Mn (105 vs. 132 mg/kg) and Zn (115 vs. 137 mg/kg) in the dried manure. Growth performance was not affected by dietary treatments. The results indicate that both organic minerals and phytase can be used to significantly lower mineral concentrations in pullet manure.

**Key Words:** Trace minerals, Organic, Manure

**M40 Influence of supplemented Azolla meal in lipid and fatty acid content in egg yolk and overall egg quality.** C. Narciso-Gaytán<sup>\*1,4</sup>, E. Ávila-González<sup>2</sup>, S. Carrillo-Domínguez<sup>3</sup>, and M. X. Sanchez-Plata<sup>4</sup>, <sup>1</sup>Universidad Autónoma Chapingo, Chapingo, Mexico, <sup>2</sup>Universidad Nacional Autónoma de México, México D. F., Mexico, <sup>3</sup>Instituto Nacional de la Nutrición Salvador Zubirán, México D. F., Mexico, <sup>4</sup>Texas A&M University, College Station.

*Azolla anabaena* is an aquatic fern traditionally used in Asian cultures as an ingredient in human and animal diets. The objective of this experiment was to evaluate the effect of Azolla meal (AM) on lipid and fatty acid content of the egg yolk and overall egg quality. Fifty four White Leghorn hens (Age: 47 weeks) were randomly distributed into 3 treatments including 0, 5 and 10% AM. Feed and water were supplied *ad libitum* during the 8-week feeding period. The results showed no statistical differences between treatments in any of the productive variables (egg production, feed intake, and feed conversion) or the egg quality characteristics tested (egg weight, Haugh units and shell thickness). However, the egg yolk color showed treatment effect as observed with changes in the b\* value which decreased with 5% AM (38.55), compared to 0 and 10% AM (41.42 and 38.55, respectively). In contrast, the a\* value was higher with the diets containing AM than the control (6.25, 5.54, and 0.89 for 5, 10 and 0% AM, respectively) ( $P < 0.05$ ). The lipid content decreased as the level of AM increased in the diet (43.18, 37.96, and 33.67 g/100g for control, 5, and 10% AM, respectively). However, the fatty acid profile had no treatment effect. These results suggest that AM can be included in the diet at levels up to 10% without negatively affecting the production and quality of the egg, and that AM can be used to reduce the lipid content in egg yolk without affecting the fatty acid profile.

**Key Words:** Azolla-Anabaena, Egg quality, Egg yolk color

**M41 Nutritive value for poultry of an extruded mixture of canola seeds and peas.** A. Golian<sup>\*1</sup>, L. Campbell<sup>1</sup>, J. Davidson<sup>2</sup>, and H. Janmohammadi<sup>1</sup>, <sup>1</sup>The University of Manitoba, Winnipeg, Manitoba, Canada, <sup>2</sup>EXP-FEEDS Inc., Shoal Lake, Manitoba, Canada.

A study was conducted to evaluate the nutritive content of ENERMAX™ which is a blend (50:50 w/w) of full-fat canola seeds and peas. Two duplicated samples were provided by EXP-FEEDS both as final (extruded at 138°C with a retention time of 15 seconds) and pre-extrusion (unprocessed) products. As some proportion of off-grade (bin-heated, immature) canola seeds may be used in the process a companion study was conducted to determine the effect of heat-treat-

ment (bin-heated canola seed) on nutrient availability. The precision-fed adult rooster assay was used to determine the true metabolisable energy (TMEn) and true amino acid digestibility (TAAD) contents of variously treated feed samples. Both intact and cecectomized roosters were used in the assays. Degree of heat damage of canola seeds (n = 5) was assessed by determining sample contents of NDF and NDF-nitrogen and by visual examination. The average TMEn (kcal/kg DM) of the extruded product was 4051 ± 93 (n = 16) for intact birds and 4019 ± 110 (n = 16) for cecectomized birds while the TMEn of the non-extruded product was 3754 ± 136 (n = 16) in cecectomized birds. These data indicate a high availability energy content of the extruded product with little difference in TMEn content when measured using either intact or cecectomized roosters. Available amino acid content of canola seed was markedly influenced by degree of heat damage as average TAAD values were 90% for control (un-heated) seed and 66% for heat-damaged (80% bin-heated) canola seed. A linear decrease in lysine TAAD values for samples showing a corresponding linear increase in NDF or NDF-nitrogen values indicated that these latter chemical measures can be used to estimate heat damage effects on nutritive value of the product and hence serve to monitor the use of off-grade canola seed in the commercial process.

**Key Words:** Poultry, Nutritive value, Extruded canola seed / pea mixture

**M42 Identification of two splice variants of the chicken cationic amino acid transporter-2 gene.** D. I. Morris and B. D. Humphrey\*, *University of Maryland, College Park.*

Cationic amino acid transporters (CAT) contain multiple isoforms that mediate cellular uptake of lysine and arginine. The mammalian CAT-2 (mCAT-2) primary transcript is alternatively spliced to produce mCAT-2A & mCAT-2B. To determine if chickens contain CAT-2 splice variants, the alignment of an expressed sequence tag (EST) with high homology to mCAT-2 was determined within the chicken genome using the basic local alignment search tool (BLAST) algorithm. The EST sequence aligned with >98% nucleotide homology to exon regions of a novel gene predicted to encode two transcripts that differ in the use of exon 6 or 7 at the same position of the mRNA. A primer-directed, reverse transcription-polymerase chain reaction (PCR) strategy was utilized to determine if these predicted transcripts were expressed in chicken tissues and cell types. Primers to chicken CAT-2 were designed within exon regions of the novel gene. One primer pair flanked the potentially alternatively spliced region. Since mCAT-2A is exclusively expressed in the liver, hepatic tissue was collected from 14 d old male broiler chicks. Since mCAT-2B is induced by lipopolysaccharide (LPS), 14 d old male broiler chicks were injected s. c. with LPS (1 mg/kg BW). Splenocytes were isolated 12 h later. PCR products from liver and splenocytes were subject to bi-directional sequencing. Liver CAT-2 PCR products generated one contiguous nucleotide sequence containing exon 6. Splenocyte CAT-2 PCR products generated two contiguous nucleotide sequences. One CAT-2 sequence contained exon 6 and the other sequence contained exon 7. The BLAST algorithm was used to determine the homology of chicken CAT-2 exon 6 & 7 to the alternatively spliced regions of mCAT-2A & 2B. Liver CAT-2 exon 6 had 84% & 54% amino acid homology to mCAT-2A & 2B, respectively. Splenocyte CAT-2 exon 7 had amino acid homology (87%) to mCAT-2B only. These results indicate that the chicken CAT-2 gene is alternatively spliced to produce two isoforms sharing high homology to mCAT-2A & mCAT-2B.

**Key Words:** Arginine, Lysine, Transport

**M43 The effect of water manganese on broiler growth performance.** A. Batal\*, B. Fairchild, C. Ritz, and P. Vendrell, *University of Georgia, Athens.*

Groundwater used for poultry production can have elevated levels of manganese (Mn) due to inherent geochemical processes. Approximately 18% of the groundwater tested in Georgia had Mn concentrations above the generally accepted problem level of 0.05 ppm. Hence, two experiments were conducted to study the effects of high manganese (Mn) concentrations on broiler growth performance. Cobb 500 male broiler chicks were housed in Petersime batteries equipped with a Ziggity® nipple water system. Chicks were fed a standard corn-soybean meal diet that meet or exceeded the nutrient recommendations of NRC (1994). Chicks were allowed ad libitum access to feed and water. Chick weight, feed intake, and water consumption were recorded weekly throughout the 35

day experiments. In both experiments five replicate pens of ten birds were allotted to the four water treatments which consisted of 0, 0.05, 1.0, and 20 ppm supplemental Mn ( $MnSO_4 \cdot H_2O$ ). Water treatments were mixed on a weekly basis. Fresh and week old water treatment samples were taken for weeks 0, 2, and 4 to verify that the desired level of Mn was in the treatment water and had not precipitated out of solution due to oxidation. Analyzed levels of Mn in the treatment water were very similar to the desired levels. The addition of Mn sulfate had little effect on water pH which ranged from 7.30 to 6.99 for the 0 and 20 Mn ppm treatments, respectively. Manganese sulfate had no effect on weight gain, feed intake, feed efficiency (gain to feed) or water intake in both experiments. Based on these results, we concluded that the level of Mn contamination in drinking water up to 20 ppm does not affect broiler performance. The effect that high levels of Mn or its oxidized byproducts may have on equipment was not evaluated, although field observations suggest that levels as low as 0.05 ppm Mn can cause nipple drinkers to leak or leave black deposits in water lines and clog filters.

**Key Words:** Water, Manganese, pH

**M44 Chickens cecal methanogen quantification by MPN and preliminary identification of methanogenic archaea based on 16S rDNA.** S. Saengkerdsab<sup>1</sup>, S. A. Sirsat<sup>1</sup>, R. C. Anderson<sup>2</sup>, C. L. Woodward<sup>1</sup>, W. K. Kim<sup>1</sup>, D. J. Nisbet<sup>2</sup>, and S. C. Ricke<sup>1</sup>, <sup>1</sup>Texas A&M University, College Station, <sup>2</sup>US Department of Agriculture, College Station, TX.

Methanogenic archaea are strict anaerobic microorganisms living in animal gastrointestinal tracts including chickens. However, only one study previously isolated methanogens from chicken feces. The objective of the current study was to quantify and tentatively identify methanogens present in the chicken cecum. Twenty-four chickens were divided into four groups and were sacrificed to take cecal contents. Six ceca of each group were transferred and mixed together in an anaerobic glove box. Dilutions from  $10^{-5}$  to  $10^{-12}$  were inoculated in five serum tubes containing Balch 1 medium supplemented with rumen fluid and additional  $NH_4 Cl$ . Each tube was flushed with 80% hydrogen/20% carbon dioxide under 200 kPa and maintained at 37°C. After 20 days, methane gas was determined in the headspace by gas chromatography. Tubes with methane concentrations greater than 100 ppm (mg/ml) were counted positive for the determination of methanogens by most probable number (MPN). In this study, fresh bovine rumen fluid was used as positive control. The fluid was diluted from  $10^{-3}$  to  $10^{-10}$  and incubated as described above. By using the MPN method, twenty-four ceca harbored methanogens between a log<sub>10</sub> of 6.4 to 8.2 per gram wet weight. Based on preliminary studies on methanogen 16S rDNA isolated thus far, the results showed methanogen diversity in a chicken cecum was minimal. Five 16S riboprint patterns were observed and only one riboprint pattern was composed of 97% of 133 16S rDNA clones. All five 16S riboprint patterns were sequenced and compared by using the Basic Local Alignment Search Tool (BLAST) in GenBank. All methanogen sequences were 98% sequence similar to *Methanobrevibacter woesei* GS (accession number U55237) which had been isolated previously from goose feces.

**Key Words:** Methanogenic archaea, 16S rDNA, Most-probable-number (MPN)

**M45 Characterization of *Salmonella* isolates by serotype, antibiotic susceptibility test and pulsed field gel electrophoresis from the feces of laying hens in a commercial layer complex.** X. Li<sup>1</sup>, J. Levine<sup>1</sup>, and B. Sheldon<sup>2</sup>, <sup>1</sup>Department of Public Health and Pathology, <sup>2</sup>North Carolina State University, Raleigh.

As part of a longitudinal study to survey *Salmonella* prevalence and populations in poultry and swine production environments, the objective of this study was to characterize the diversity of *Salmonella* isolates from feces of commercial laying hens. Fecal samples were sampled from September 2003 to July 2004 from a commercial North Carolina layer complex containing multiple houses. Forty-five *Salmonella* isolates were serotyped and tested for antibiotic susceptibility using the disk diffusion method. Fifteen *Salmonella* isolates were genotyped using pulsed field gel electrophoresis (PFGE). Our results show that *Salmonella* serovar Kentucky (62%) was the most common serotype isolated from the fecal samples followed by Montevideo (11%), untypable (11%), Typhimurium (Copenhagen, 4%), Heidelberg (4%), Senftenberg (2%), 8,(20)

Nonmotile (2%) and 8,(20):z6 (2%). Furthermore, 35.5% (16/45) of the *Salmonella* isolates tested were resistant to at least one antibiotic. Specifically, 6.7, 2.2, 4.4, 2.2, 4.4, 4.4, 2.2 and 2.2 percent of the *Salmonella* isolates were resistant to tetracycline, streptomycin, streptomycin/tetracycline, ampicillin/tetracycline/ceftiofur, ampicillin/ceftiofur/ceftriaxone, ampicillin/ceftiofur, ampicillin/streptomycin/tetracycline, ampicillin/streptomycin/tetracycline/ceftiofur, ampicillin/tetracycline and ampicillin/streptomycin/tetracycline/ceftiofur/ceftriaxone, respectively. There were five main genetic clusters with greater than ninety percent similarity among the fifteen *Salmonella* isolates. Interestingly, two of the *Salmonella* serovars, Heidelberg and Kentucky, produced the same PFGE pattern. These findings demonstrated that this particular commercial layer complex was contaminated with multiple *Salmonella* serovars of varying antibiotic resistance and PFGE gene patterns.

**Key Words:** Serotype, PFGE, Antibiotic susceptibility test

**M46 The influence of a fructooligosaccharide (FOS) prebiotic combined with alfalfa molt diets on the gastrointestinal tract of laying hens and *Salmonella enteritidis*.** L. F. Kubena<sup>1</sup>, L. M. Donalson<sup>2</sup>, J. L. McReynolds<sup>1</sup>, C. L. Woodward<sup>2</sup>, S. C. Ricke<sup>2</sup>, J. A. Byrd<sup>1</sup>, and D. J. Nisbet<sup>1</sup>, <sup>1</sup>USDA-ARS, SPARC., College Station, Texas, <sup>2</sup>Texas A&M University, College Station.

The United States Poultry industry commonly uses feed withdrawal to effectively induce molt; however, recent animal welfare and food safety concerns have encouraged producers to seek alternative molting methods due to the increased susceptibility to *Salmonella* Enteritidis (SE). An alternative method to feed withdrawal includes feeding high fiber diets such as alfalfa, which has been shown to decrease the incidence of SE colonization, and when combined with a prebiotic, has shown to further decrease SE infection. Prebiotics such as FOS have been shown to stimulate growth and activity of colonic bacteria, thus improving the host health. In this study, 60 laying hens were induced to molt with 3 alfalfa based diets (A90 = 90% alfalfa, 10% layer ration); H= 90% alfalfa, 10% layer ration, 0.75% FOS; and L= 90% alfalfa, 10% layer ration, 0.375% FOS, FW= feed withdrawal and non-molted, FF= full fed control. On day 4, the hens were challenged and then half were sacrificed on day 9 for organ collection. After the 9 day molt, hens from the FW group had overall higher invasion of organs; whereas, the other molt treatments (H & L) were not significantly different ( $P > 0.05$ ) from FF hens. Total VFA concentrations were significantly lower in FW hens when compared to all other treatments; however, lactic acid concentrations were significantly ( $P > 0.05$ ) higher in all 3 alfalfa molt treatments. The addition of FOS to the A90 diet further increased total VFA and lactic acid concentrations, although not significantly higher than A90. These results could have been affected by feed intake by alfalfa treated hens, as there were few significant differences between hens fed H and L amounts of FOS. It may be possible to feed a lower quantity of FOS and still retain the benefits of a higher dosage.

**Key Words:** *Salmonella* Enteritidis, Alfalfa, FOS

**M47 Recovery and distribution of *Escherichia coli* from poultry house surgical shoe covers, shallow litter, and deep litter samples.** B. McCreary\*, K. Macklin, R. Norton, J. Hess, and S. Bilgili, Auburn University, Auburn, Alabama.

*Escherichia coli* are indicator organisms for fecal contamination. Current litter assessment methods include pooled litter samples and drag swabs. Our study was aimed at sampling different litter depths during the course of a growout to see if recovery was affected or if differing strains of *E. coli* could be revealed. Surface sampling methods such as drag swabs and surgical shoe covers might yield *E. coli* strains representing shallow litter but not deep litter, if such differences existed.

Peanut hulls, over dirt floors, were used as litter on participating farms. Two commercial farms, each with four houses, were visited three times during each growout. Sampling took place over two successive flocks. Poultry litter consisted of peanut hulls and was top dressed prior to chick placement but total cleanouts were performed annually. Shallow litter consisted of samples from the top 2 inches of the litter, while deep litter consisted of the bottom 2 inches

of the litter. Surgical shoe covers, as an alternative method to drag swabs, were used to assess the recovery of *E. coli* from litter. Those samples that yielded characteristic growth on MacConkey agar were then placed in an automated ribotyping system for subtyping.

Every visit yielded *E. coli* for all three sampling methods. Although not all houses on each visit produced suspects. Of those, 65.4% of the *E. coli* suspects were confirmed by the RiboPrinter® (n=83). Additionally, 1.6% of the *E. coli* suspects were identified as other bacteria (n=2). Unfortunately, 33.0% of the *E. coli* suspects were typed as unknowns (n=42). Of the suspects confirmed by the RiboPrinter®, 63% of surgical shoe cover (n=29), 62.5% of shallow litter (n=25), and 70.7% of deep litter (n=29) samples were identified as *E. coli*. A total of 25 different strains of *E. coli* were revealed with 36% of isolates belonging to just four strains. All strains recovered and ribotyped were randomly distributed among sampling methods, houses, and age groups.

**Key Words:** *E. coli*, Poultry litter, Automated ribotyping

**M48 Recovery of *Campylobacter jejuni* from broiler house samples during four consecutive flocks: Dendrogram.** B. McCrea\*, K. Macklin, R. Norton, J. Hess, and S. Bilgili, Auburn University, Auburn, Alabama.

*Campylobacter* spp. are a heavily scrutinized yet enigmatic bacterial species to the poultry industry. The bacterium does not cause disease in birds but broilers are a primary reservoir for this common food-borne pathogen. Two commercial broiler farms, each with four houses, were monitored to determine the source of isolates found on carcasses in the processing plant. Both farms were initially thoroughly cleaned, disinfected and the litter was top-dressed prior to the placement of chicks. Each farm was visited on chick delivery day, at 3.5 weeks of age, and on processing day. On chick delivery day, environmental samples of each house were collected. This included taking samples from feed, litter, insects, water, litter drag swabs, equipment swabs (fans, walls, evaporative pads, feed equipment), and wellhead. At 3.5 weeks of age, environmental samples were repeated with the addition of cecal droppings. On the day of processing, in addition to the environmental samples, birds were followed through the processing plant. At the plant, transport crates were swabbed and carcass rinses were taken before the chiller, immediately after the chiller, and after the antimicrobial dip.

Those samples that yielded characteristic results via traditional biochemical tests were then placed in an automated ribotyping system for subtyping. *Campylobacter* was never recovered from samples taken on chick placement day for the duration of the study. Every flock yielded *Campylobacter* through surgical shoe covers, drag swabs, feed equipment swabs, cecal droppings, transport crates, pre-chiller rinsates, or post-chiller/pre-antimicrobial dip rinsates. *C. jejuni* was the only species of *Campylobacter* recovered among the 105 isolates. The three most common strains recovered and ribotyped showed 87% genetic similarity. Among these three strains there were two distinct groups, one of which contained only strain 2050, the most frequently found isolate (55%). There was a pattern to the recovery of the three main isolates indicating their retention from several flocks on the farm through the processing plant.

**Key Words:** *Campylobacter* spp., Broiler house, Automated ribotyping

**M49 The influence of mushroom extract on broiler performance and health.** W. Willis\*, O. Isikhuemhen, and C. Murray, North Carolina A&T State University, Greensboro.

An experiment was conducted to evaluate the use of Shitake (*Lentinus edeods*) mushroom extract on broiler performance and health. Eighty day of hatch female broiler chickens were obtained from a local commercial hatchery. Chicks were weighed, randomly assigned to two treatment groups, replicated four times (10 chicks per replicate) and placed on pinewood-shaving in floor pens. The mushroom extract was diluted in water and administered *ad-libitum* to chicks in the experimental group for 4 weeks while the control was given water. Feed was free of antibiotics or other medications. Measurements taken were body weight gain, dress weight, feed and water consumption, intestinal lesion scores, mortality, liver, gizzard, spleen and relative bursa weights. The experiment was terminated at 49-days of age. The weight gain (2.523 vs. 2.472 kg) and dressed carcass weight (1.805 vs. 1.636 kg) were significantly (P<0.05) higher for the

control, when compared to the experimental treatment, respectively. Liver, gizzard, spleen, relative bursa weights, and mortality did not differ significantly (P<0.05). Intestinal lesion scores did not differ between treatments. There was a significantly (P<0.05) higher consumption of water for the control when compared to the mushroom extract. Feed consumption was higher for the experimental group averaging (5.28 vs. 5.03 kg), respectively. In conclusion, the supplementation of drinking water with mushroom extract reduced weight gain, water intake and increased feed intake in broiler chickens. No enhancement of health and performance were observed with the mushroom extract.

**Key Words:** Broilers, Mushrooms

**M50 In vitro fermentation of various feed substrates using chicken cecal inocula.** K. Dunkley\*<sup>1</sup>, C. Dunkley<sup>1</sup>, N. Njongmeta<sup>1</sup>, T. Callaway<sup>2</sup>, M. Hume<sup>2</sup>, L. Kubena<sup>2</sup>, D. Nisbet<sup>2</sup>, and S. Ricke<sup>1</sup>, <sup>1</sup>Texas A & M University, College Station, <sup>2</sup>USDA-ARS, Southern Plains Agricultural Research Center, College Station, Texas.

The objective of this study was to investigate and compare the in vitro potential fermentability of alfalfa and other high fiber feed sources that could be used to formulate a more refined alternative molting diet that retains the protective microflora. Feed examined include soybean meal, soybean hull, beet pulp, wheat middling, ground sorghum, cotton seed meal, 100% alfalfa meal, 90% alfalfa + 10% commercial layer ration (A90), 80% alfalfa + 20% commercial layer ration (A80), 70% alfalfa + 30% commercial layer ration (A70). A Polymerase Chain Reaction-based Denaturing Gradient Gel Electrophoresis (DGGE) method based on 16S rRNA gene amplification was also used to determine the bacterial profile of each sample after fermentation. Cecal contents from laying hens were diluted 1:3000 with anaerobic dilution solution. All feed substrates were grounded through a 1-mm sizer machine, 0.5 g feed substrates and 10 ml inoculum were placed anaerobically in serum tubes and incubated at 39°C for 24 h. Samples in two trials were analyzed at 0 and 24 h for SCFA. SCFA in samples at 0 h were subtracted from 24 h samples to determine the net production of SCFA. It was clear that SCFA production was significantly higher (P < 0.05) in Trial 2 than Trial 1. Acetate, propionate and butyrate were the dominant SCFA, while isobutyrate, valerate and were significantly lower. The results revealed that alfalfa based samples yielded consistently higher SCFA levels, A90 in Trial 2 yielded the highest (231.47 ± 30.66 μmoles/ml) acetate production followed by soybean meal (213.36 ± 6.84 μmoles/ml). DGGE results from both Trials indicated variation in microbial populations, dendrograms of amplicon band patterns demonstrated 69 and 71% similarity for comparison of all feed mixtures in Trials 1 and 2, respectively. These data suggest that high fiber sources may be a contributing factor in the level of fermentation that occurs in the ceca and the cecal microbial diversity exhibited by laying hens.

**Key Words:** SCFA, DGGE, Microbial ecology

**M51 Presence of various naturally occurring bacteria in unabsorbed yolks of six week old commercial broilers.** N. A. Cox\*<sup>1</sup>, L. J. Richardson<sup>1</sup>, R. J. Buhr<sup>1</sup>, J. K. Northcutt<sup>1</sup>, B. D. Fairchild<sup>2</sup>, J. M. Mauldin<sup>2</sup>, and J. S. Bailey<sup>1</sup>, <sup>1</sup>USDA-ARS, Athens, Georgia, <sup>2</sup>University of Georgia, Athens.

Commercial broilers (6 weeks of age) were obtained from a processing plant after defeathering but prior to evisceration and transported to the laboratory. Each carcass was hung on a shackle by the feet and aseptically cut open. From the carcasses, the free floating unabsorbed yolk, yolk stalk, attached unabsorbed yolk and stalk, spleen, liver/gallbladder and ceca were aseptically removed and individually analyzed. The free floating unabsorbed yolks, unabsorbed attached yolks and the yolk stalks were analyzed for levels and types of total bacteria (TPC), *Enterobacteriaceae* (ENT), *Campylobacter* and *Salmonella*. The spleen, liver/gallbladder, and ceca were analyzed for the presence of *Campylobacter* and *Salmonella*. In trial 1, the average TPC and ENT was greater than log 6.0 in the three attached unabsorbed yolks and one of the free floating unabsorbed yolks. For the other two free floating unabsorbed yolks the TPC was log 3.3 and ENT was log 2.8. For the three yolk stalk samples the TPC was log 5.1 and ENT was log 5.0. *Campylobacter* was found in 1/3 attached unabsorbed yolk samples and was not present in any other yolk samples. *Campylobacter* was present in 3/6 spleens, 3/6 liver/gallbladders, 2/6 ceca and *Salmonella* was not present. In trial 2, the average TPC and ENT was greater than log 6.0 in the three attached

unabsorbed yolk samples, two of the free floating unabsorbed yolks and two of the yolk stalks. For the other free floating unabsorbed yolk sample, TPC was log 3.7 and ENT was not found at the lowest dilution. For the one remaining yolk stalk, the average TPC was log 2.6 and ENT was log 4.8. *Salmonella* was present in 2/3 attached unabsorbed yolks, 2/6 spleens and 2/6 liver/gallbladders and 1/6 ceca and *Campylobacter* was not present. *Streptococcus* spp. and *Staphylococcus* spp. was the predominant organism in TPC, while *Escherichia coli* and *Hafnia alvei* was found to comprise ENT samples. This study is further evidence that *Campylobacter*, *Salmonella*, and other bacteria are naturally present in many internal tissues of a six week old broiler. The significance of these bacterial reservoirs is yet to be determined.

**Key Words:** *Campylobacter*, *Salmonella*, Unabsorbed yolk

**M52 Presence of *Campylobacter jejuni* in the internal organs of inoculated broiler breeder hens.** N. A. Cox<sup>\*1</sup>, L. J. Richardson<sup>1</sup>, R. J. Buhr<sup>1</sup>, J. S. Bailey<sup>1</sup>, J. L. Wilson<sup>2</sup>, D. E. Cosby<sup>1</sup>, and D. V. Bourassa<sup>2</sup>, <sup>1</sup>USDA-ARS-Russell Research Center, Athens, Georgia, <sup>2</sup>University of Georgia, Athens.

Two studies were conducted to determine if *Campylobacter jejuni* could reside in the internal organs of adult broiler breeder hens. In study 1, university housed broiler breeders at 22 weeks of age were obtained and placed in individual cages. Each hen was vaginally inoculated weekly from 23 to 32 weeks of age with a characterized strain of *Campylobacter jejuni*. Four days post-inoculation at weeks 23, 27, and 32, hens were euthanized, de-feathered and aseptically opened. In study 2, university housed broiler breeder hens were obtained at 42 weeks of age, placed in individual cages and inoculated either orally or vaginally with a characterized strain of *Campylobacter jejuni*. To reduce the possibility of cross-contamination between samples, the thymus, spleen, and liver/gallbladder were aseptically removed, prior to the ceca. In both studies samples were individually analyzed. In study 1, at 23 weeks of age *Campylobacter jejuni* was found in 4/7 thymus, 2/7 spleens, 5/7 liver/gallbladders, and 6/7 ceca. At 27 weeks of age, *Campylobacter jejuni* was found in 1/7 thymus and 1/7 ceca. At 32 weeks of age, *Campylobacter jejuni* was found in 4/11 thymus, 1/11 liver/gallbladders, and 2/11 ceca. In study 2, *Campylobacter jejuni* was found in 2/6 thymus and 5/6 ceca after oral inoculation. *Campylobacter jejuni* was found in 1/6 spleen, 1/6 liver/gallbladders, and 4/6 ceca after vaginal inoculation. This study provides evidence that *Campylobacter jejuni* can be isolated from the internal organs of broiler breeder hens. However, neither age at the initiation of inoculation or route of inoculation influenced the breeder hen colonization for *Campylobacter jejuni*. These results still do not prove to what extent oral and vaginal inoculation plays in flock contamination.

**Key Words:** *Campylobacter jejuni*, Broiler breeder, Lymphoid organs

**M53 Incidence and size distribution of unabsorbed yolk sacs in commercial broilers processed at six weeks of age.** R. J. Buhr<sup>\*1</sup>, D. V. Bourassa<sup>1,2</sup>, J. K. Northcutt<sup>1</sup>, L. J. Richardson<sup>1</sup>, N. A. Cox<sup>1</sup>, and B. D. Fairchild<sup>2</sup>, <sup>1</sup>USDA-ARS Russell Research Center, Athens, Georgia, <sup>2</sup>The University of Georgia, Athens.

Unabsorbed yolk sacs are being investigated as a possible vehicle for vertical transmission of *Campylobacter* and salmonellae from broiler breeder hens to broilers. However, it is unknown at what frequency unabsorbed yolk sacs exist in present day commercial broilers at the time of processing. Two hundred broiler carcasses (100 on each of two separate days) were obtained from a commercial processing plant following defeathering and transported to the pilot processing plant. Each carcass was aseptically opened and inspected for the presence of an unabsorbed yolk sac. For each carcass, the antimesenteric side of the mid-ileum segment of the small intestine was examined for the presence or absence of a yolk stalk (Meckel's diverticulum). Carcasses with obliterated yolk stalks or stalks with no detectable yolk material were categorized as normal. Those with unabsorbed yolk sacs were further separated into two groups: 1) attached to the yolk stalk; or 2) free-floating within the abdominal cavity. Yolk sacs were further classified by size: 1) small (less than 2 mm in diameter); 2) medium (2 mm to 10 mm); and 3) large (greater than 10 mm). From the 200 broiler carcasses, 51% were categorized as normal, 34% had an unabsorbed yolk sac attached to the yolk stalk, and 15% were free-floating. Of the 68 unabsorbed yolk sacs attached to yolk stalks, 26.5% were classified as small, 7% as medium, and 0.5% as large. Of the 30 unabsorbed free-floating yolk sacs, 6.5% were classi-

fied as small, 8% as medium, and 0.5% as large. While most of the unabsorbed yolk sacs were dark yellow in color and were pliable, others were black and hard. The incidence of unabsorbed yolk sac in 6-wk-old commercial broilers appears high (49%). Future evaluation of broiler stocks maintained from the 1950's will determine if the frequency of unabsorbed yolk sacs has changed in the past 50 years of selection for modern broilers.

**Key Words:** Unabsorbed yolk sac, Processed broilers, Frequency

**M54 Effect of drinking water iron concentration on broiler performance.** B. Fairchild<sup>\*</sup>, A. Batal, C. Ritz, and P. Vendrell, *University of Georgia, Athens.*

Many parts of the nation have elevated iron concentrations in drinking water and poultry producers are uncertain of the effect this will have on broiler performance. Three trials were conducted to evaluate the effects of iron concentration on broiler performance. At hatch Cobb 500 male broiler chicks were placed in Petersime batteries equipped with a nipple watering system. Chicks were weighed and randomly allocated to pens such that each pen had a similar weight distribution. Chicks were fed a standard corn-soybean meal diet to meet or exceed NRC recommendations. Chicks were allowed ad libitum access to feed and water. Weekly chick weight, feed intake, and water consumption were recorded throughout the 35 day trials. In Trials 1 and 2, five replicate pens of ten birds were allocated to the four water treatments which consisted of 0, 2, 20, and 200 ppm supplemental Fe (FeSO<sub>4</sub>). In Trial 3, the treatments were 0, 200, 400, and 600 ppm supplemental Fe. Water treatments were mixed on a weekly basis.

No differences were noted in body weight, feed consumption, water consumption or mortality in any of the trials. None of the birds in the treatments exhibited any signs of flushing or other intestinal problems. These results indicate that iron concentrations in water do not affect broiler performance. Broiler performance was not affected by elevated sulfate levels or reduced water pH. While iron may not have a direct effect on broiler performance, this study did not take into account the effect that high levels of Fe or its oxidized byproducts may have on equipment function.

**Key Words:** Broiler, Iron, Drinking water

**M55 Effect of water iron concentration on soluble phosphorous levels in broiler manure.** C. Ritz<sup>\*</sup>, A. Batal, B. Fairchild, and P. Vendrell, *The University of Georgia, Athens.*

Groundwater used for poultry production commonly has elevated levels of iron. High levels of iron have been shown to indirectly impact broiler performance. It has been suggested that high levels of iron may also increase water soluble phosphorous in land applied broiler litter. Two experiments were conducted to study the effects of high iron on broiler performance and corresponding manure characteristics. Cobb male chicks were housed in Petersime batteries equipped with a nipple watering system. In both experiments, five replicates of ten birds were assigned to four water treatments which consisted of 0, 2, 20, and 200 ppm supplemental Fe (FeSO<sub>4</sub>-H<sub>2</sub>O). Water treatments were mixed on a weekly basis. Manure samples were collected at 35 days of age and analyzed for Total Dissolved Phosphorous (TDP) and Molybdate Reactive Phosphorous (MRP) levels. Analysis data is found in the accompanying table. The addition of Fe had little effect on the level of phosphorous in the manure. Although the values appear to increase linearly, no statistically significant linear or quadratic increase was observed in TDP or MRP with the increased addition of iron to the water. Based on these results, the level of Fe contamination in drinking water up to 200 ppm does not affect soluble phosphorous in broiler litter.

#### Effect of Iron Concentration on Manure Soluble Phosphorous

| Treatment    | TDP (ppm) | MRP (ppm) |
|--------------|-----------|-----------|
| 0 ppm Iron   | 3852      | 3048      |
| 2 ppm Iron   | 4063      | 3194      |
| 20 ppm Iron  | 4264      | 3291      |
| 200 ppm Iron | 4388      | 3364      |
| Pooled SEM   | 471.4     | 372.3     |

**Key Words:** Iron, Phosphorous, Broiler manure

**M56 Effects of diluents, cryoprotectants, equilibration time, and thawing temperature on cryopreservation of duck semen.** Z. Y. Niu<sup>1</sup>, X. F. Han<sup>1</sup>, F. Z. Liu<sup>\*1</sup>, and C. S. Yang<sup>1,2</sup>, <sup>1</sup>Northwest A & F University, Yangling, Shaanxi, China, <sup>2</sup>National Center of Poultry Science, Shanghai, China.

A series of sequential experiments were carried out to determine optimum diluents, cryoprotectants, equilibration time, and thawing temperature for frozen duck semen in order to set up the commercial semen cryopreservation techniques which could be applied to the conservation of genetic resources, breeding, and commercial production in domestic ducks. In experiment 1, The seven semen extenders were studied to determine efficacy of the diluent on cryopreservation of duck Semen. The result showed that the diluent which contains 0.14% potassium citrate, 1.40% sodium glutamate, 0.98% disodium hydrogen phosphate, 0.21% sodium dihydrogen phosphate, 0.7% glucose, and 0.7% inositol was better than other six semen diluents. In experiment 2, the effects of various concentrations of cryoprotectants including glycerol, dimethylsulphoxide (DMSO), dimethylacetamide (DMA), and dimethylformamide (DMF) on cryopreservation of bird semen were evaluated. The results showed that the cryoprotectant containing 10% DMSO was better than others. The experiment 3 was conducted to determine the effect of equilibration time and thawing temperature on cryopreservation of bird semen. The optimum equilibration time was 15 min, and the optimum thawing temperature was 4.4 C.

**Key Words:** Duck, Semen, Diluents

**M57 A comparison of fat deposition and heterotic effect analysis between different meat-type chickens during growing period.** F. Z. Liu<sup>\*</sup>, Z. Y. Niu, and S. W. Zhai, Northwest A&F University, Yangling, Shaanxi, China.

The abdominal fat pad weight and heterotic effect of fat growth among White Feather Lueyang (WL), Arbor Acres (AA), and their F1 had been analyzed and compared during the bird growing period in this experiment. The result showed that, from two week of age, the abdominal fat weight of AA broilers had been significantly higher than that of Lueyang ( $P < 0.01$ ), fat growth speed of F1 was between their parents, but after four weeks of age, the fat weight of F1 significantly lower than that of their father AA broilers ( $P < 0.05$  or  $P < 0.01$ ) and higher than that of their mother WL. Moreover, the growth ratio of abdominal fat weight and body weight of F1 broilers had been higher than their parents from two weeks of age to twenty two weeks of age. When studied the fat cytology parameters, the result demonstrated that the heterotic effects to fat growth of meat-type chickens was mainly decided by the change of fat cell size. The heterotic effect in the adipocyte hypertrophy was significantly positive, this is why the growth velocity and amount of fat tissue in hybrid chickens was significantly more than that of their parents.

**M58 Colibacillosis and turkey osteomyelitis complex in turkeys selected for increased body weight and subjected to stress.** G. R. Huff<sup>\*1</sup>, W. E. Huff<sup>1</sup>, N. C. Rath<sup>1</sup>, J. M. Balog<sup>1</sup>, N. B. Anthony<sup>2</sup>, and K. E. Nestor<sup>3</sup>, <sup>1</sup>USDA/ARS/PPPSRU, Fayetteville, AR, <sup>2</sup>University of Arkansas, Fayetteville, <sup>3</sup>OARDC, Wooster, OH.

Two stress models were used to induce colibacillosis and turkey osteomyelitis complex (TOC): *Escherichia coli* challenge following dexamethasone injection (Dex) and *E. coli* challenge preceding transport stress (Transport). A total of 160 birds from 3 lines of turkeys: a slow growing line selected for increased egg production (Egg line), a line selected for increased 16 wk BW (F line), and a commercial line (Comm), were studied in a 3 X 3 X 2 (Line X Treatment X Sex) factorial design. At 14 wks, the Dex group was treated with 3 injections of 2mg Dex/kg BW followed by airsac challenge with 100 cfu of *E. coli*. The Transport group was airsac challenged with 5000 cfu of the same *E. coli*, and 8 d later was transported for 3 h and held an additional 9 h in the transport vehicle. Birds were necropsied 2 wk post challenge. All birds were sexed, scored for airsacculitis (AS) and TOC, and knee synovia was cultured for *E. coli*. Percent mortality was unaffected by Sex, was increased by both treatments and was higher in the Comm line as compared to the Egg line. Both treatments increased AS scores and scores of Dex challenged birds were higher in both large lines as compared to the Egg line. Male Comm birds under Transport had

higher AS scores as compared to females. TOC incidence was increased by Dex only and there was no TOC in Egg line birds. TOC incidence was higher in the F line as compared to the Egg line and was intermediate in the Comm line. Males had twice as much TOC as females and this approached significance in the F line ( $P = 0.06$ ). The challenge strain of *E. coli* was isolated from more knee cultures of both large lines as compared to the Egg line and isolation was increased by Dex and unaffected by Sex. The difference in disease resistance between these lines suggests that selection for fast growth of turkeys may affect the stress response, resulting in increased chronic bacterial disease such as TOC.

**Key Words:** Turkey osteomyelitis complex, Stress, Genetics

**M59 Longitudinal vs. cumulative analysis of fertility and hatchability in chickens.** R. L. Sapp<sup>\*1</sup>, R. Rekaya<sup>1</sup>, I. Misztal<sup>1</sup>, and T. Wing<sup>2</sup>, <sup>1</sup>The University of Georgia, Athens, <sup>2</sup>Cobb-Vantress, Inc., Siloam Springs, Arkansas.

The objective of this study was to compare the performances of a longitudinal multiple-trait (MT) and single-trait (ST) best linear unbiased prediction (BLUP) analyses for eggs set (E), percentage fertility (F), and percentage hatched of fertile eggs (H) based on rank correlations of hens and roosters (ROO). Longitudinal data consisted of weekly records and the ST analysis utilized cumulative records of the three traits. Comparisons were carried out using simulated data, where the true values assigned during the simulation were compared with estimated solutions obtained from MT and ST analyses. Two methods were used to calculate breeding values (BV) and ROO solutions. Weekly E records equal to zero were assumed as valid records, and missing weekly F and H records were predicted in MT analysis. However, missing F and H were not included in the cumulative record. Weekly E, F, and H records were converted to a cumulative record following a procedure used by a commercial broiler company. Further, ST models were developed to evaluate hens and ROO separately as currently practiced in the industry. There was virtually no difference in hen rank correlations between true and predicted BV obtained from MT (0.64) and ST (0.62) analyses for E; thus suggesting that hens would rank similarly when weekly or cumulative data were used for genetic evaluation of E. Using a ST analysis, rank correlations between true and estimated hen BV decreased, compared with MT analysis, by 74% and 75% for F and H, respectively. For F (H), the rank correlation between true and estimated ROO effects were 0.64 (0.67) and 0.17 (0.12), using the MT and ST analyses, respectively. The results suggest that longitudinal MT BLUP, which handles missing records, was better at estimating true hen and ROO effects than ST BLUP. Furthermore, the method of computing the cumulative F and H record, and removing missing records of F and H, attributed to the poor estimation by ST BLUP analysis. Therefore, it is recommended that the MT BLUP method be used for genetic evaluation of hens and roosters for eggs set, percentage fertility, and percentage hatched of fertile eggs.

**Key Words:** Eggs set, Fertility, Hatchability

**M60 Serum activity of glutamic oxaloacetic transaminase in broiler chickens that died from sudden death syndrome.** H. R. Aliakbarpour<sup>\*</sup> and D. Quejeq, Azad Islami University, Babol, Mazandaran, Iran.

In this work, serum glutamic oxaloacetic transaminase (GOT) activity was measured in healthy broiler chickens and from broiler chickens that died from sudden death syndrome (SDS) within 20 min after death. Blood sample (3ml) from healthy broiler chickens of 1, 2, 3, 4, 5, 6 and 7 wk of age were obtained by bleeding from the lunar vein. Also, blood samples (3ml) were obtained by bleeding from the jugular vein during 20 min after broiler chickens died from SDS. Enzyme activities were measured by spectrophotometric methods. All data were presented as mean + standard deviation. Comparison of difference between two sample means were examined using Student t-test ( $P < 0.05$ ). Our results showed that serum GOT activity in broiler chickens died from SDS was increased compared to that in the healthy group [(34.6 + 4.1) vs. 15.2 + 3.6 U/L], Mean + SD,  $P < 0.05$ . These results suggest that an elevation in serum GOT activity occur in association with SDS, and may be used as a characteristic sign of birds that are dying of SDS.

**Key words:** Broiler chicken, sudden death, creatine phosphokinase, lactate dehydrogenase, glutamic oxaloacetic transaminase.

**Key Words:** Glutamic oxaloacetic transaminase, Broiler, Sudden death

**M61 Serum activities of creatine phosphokinase and lactate dehydrogenase in broiler chickens that died from sudden death syndrome.** D. Qujeq\* and H. R. Aliakbarpour, *Azad Islami University, Babol, Mazanderan, Iran.*

In this work, serum creatine phosphokinase (CPK) and lactate dehydrogenase (LDH) activities were measured in healthy broiler chickens and from broiler chickens that died from sudden death syndrome (SDS) within 20 min after death. Blood sample (3ml) from healthy broiler chickens of 1, 2, 3, 4, 5, 6 and 7 wk of age were obtained by bleeding from the lunar vein. Also, blood samples (3ml) were obtained by bleeding from the jugular vein during 20 min after broiler chickens died from SDS. Enzyme activities were measured by spectrophotometric methods.

All data were presented as mean + standard deviation. Comparison of difference between two sample means were examined using Student t-test ( $P < 0.05$ ). Our results showed that serum CPK and LDH activities in broiler chickens died from SDS was increased compared to that in the healthy group, respectively [(174.6 + 12.3, 689.3 + 28.4 U/L) vs. 116.3 + 9.7, 395.7 + 21.4 U/L, Mean + SD,  $P < 0.05$ ]. These results suggest that an elevation in serum CPK and LDH activities occur in association with SDS, and may be used as a characteristic sign of birds that are dying of SDS.

**Key Words:** Broiler chicken, Sudden death, Creatine phosphokinase