

one diet including equal mix of these two sources (0.15+0.15), to basal diet free of Se. The basal corn-soybean meal diet was formulated to meet nutrient requirements. Ninety six birds were randomly allocated in twenty four cages in a completely randomized design. Egg production and egg weight were recorded weekly and bi weekly, respectively. Body weight and shell weight, shell thicknesses, yolk weight, albumen height of fresh eggs were evaluated monthly and every six week. Some eggs were produced in 34 and 40 weeks, kept in storage egg room for 14 days and then egg quality test was accomplished. At 40 weeks 2 hens per pen dissected and Pectoralis major and Pectoralis minor, liver, abdominal fat pad, oviduct, and ovary were removed and individually weighed. Responses were statistically significant, for egg production (31.3%), egg weight (9.6%) and body weight (5.6%) and eggs quality

(fresh and stored) with increasing amounts of both two sources of selenium in the diet. Dietary supplementation with organic Se increased ($p < 0.05$) shell thickness of fresh eggs at 34 weeks. Sources and levels of Se had no significant effect on body weight, egg production and egg weight, although trend was toward improved with organic Se. Stored eggs quality were not affected by source or levels of Se. The Se level in the diet affected the weights of the Pectoralis major, minor and liver. Reproductive parameters were also not different among the treatments. Birds fed 0.3ppm inorganic or organic Se had more numbers small yellow follicle. The results of this experiment indicated that organic Se increase egg production, yolk weight and shell thickness compared with inorganic Se.

Key Words: organic selenium, laying hens, reproduction

Metabolism and Nutrition: Nutrition B - Gut Health and Early Nutrition

40 Growth performance, gut health, and feed passage of *Salmonella*-challenged chickens reared on litter floors or in cages. D. Bohorquez*, R. Plunzke, E. Oviedo, and P. Ferket, *North Carolina State University, Raleigh*.

The growth and health response of chickens to enteric pathogens, such as *Salmonella* spp. may differ whether they are raised on litter floors or in cages. This difference may be due to the degree of colonization challenge and its effect on gut health and feed passage. Male Ross 308 broilers were randomly assigned to 32 litter floor (L) pens in a curtain-sided house or 32 cages (C) in a total confinement house (25 birds/pen or cage). All the birds were orally inoculated with 106 cfu of a mixture of *S. enterica* subspp. at 3 d of age. *Salmonella* colonization levels (MPN), body weights (BW), feed/gain (FCR), bursa, spleen, and liver weights were determined, and gut health was evaluated at 14, 28, and 42 d. Organ weights and health of intestine (incidence of thin and inflamed gut tissues) was scored on 32 birds/house. In comparison to L, C reduced 42 d BW (2748 vs. 2668 g, $p < .001$) and increased 1-42 d FCR (1.84 vs. 1.93, $p < .001$). There were no house effects on mortality rate. *Salmonella* MPN was higher in L than C at 14 d (6.452 vs. 5.152 log/g, $p < .01$), which corresponded with a higher incidence of mucoid (14.1 vs. 1.5%, $p < .01$) jejunum mucosa, and greater relative spleen and liver size at 28 d by 13% and 11%, respectively ($p < .05$). In contrast, C had higher incidence of ileal grain chips than L at 14 d (68.4 % vs. 31.5%, $p < .05$), indicating inferior gizzard function. Although birds reared on litter floors may have greater *Salmonella*-challenge than cage-reared birds, they demonstrate greater disease resistance and less feed passage, resulting in better growth performance.

Key Words: broilers, *Salmonella*, feed passage

41 Immune, growth and carcass responses to dietary threonine of broilers raised in different litter conditions. A. Corzo*¹, M. T. Kidd¹, G. T. Pharr¹, W. A. Dozier III², and E. A. Koutsos³, ¹Mississippi State University, Mississippi State, ²USDA-ARS Poultry Research Unit, Mississippi State, Mississippi, ³California Polytechnic State University, San Luis Obispo.

Needs for dietary threonine in growing broilers have been well documented, but needs for growth, carcass and immunity reared in different litter conditions are not. Two studies were simultaneously done in the same house, and evaluated digestible threonine (d-Thr) needs of Ross x Ross 708 male broilers reared under two different

litter conditions: new vs. used wood shavings (used for 4 previous flocks). Separated by a center aisle, all floor pens from one side of the close-sided house were provided new litter while the other side received used. These broilers were grown in common diets up to 21 d of age, and then fed one of six dietary d-Thr levels that ranged from 0.43 to 0.78%. At 42 d of age birds were processed, and carcass and breast meat yield were measured. As measurements of immunity, a bird from each experimental unit corresponding to either the 0.43% or 0.64% d-Thr were inoculated with SRBC at 28 d of age, and the corresponding primary response measured at 35 d of age. Additionally, at 35 d of age, a blood sample was collected from another bird per experimental unit and analyzed for white blood cell count, peripheral blood monocyte nitric oxide, and HD-11 macrophage nitric oxide. Spleen, thymus and bursa relative weights were measured at 42 d of age from one bird per pen fed either 0.43 and 0.64% d-Thr. Results for live performance and carcass traits are in close agreement with previously reported values in the literature. Quadratic responses were observed for BW gain, feed conversion, carcass and breast meat absolute and relative weights. Depending on the variable, these responses were maximized (95% of maximum response) between 0.63 and 0.66, and 0.65 and 0.70% d-Thr when broilers were raised in new and used litter, respectively. It should be noted that dietary digestible Lys was 1.00%, thus Thr to Lys ratios oscillated between 63 and 66, and 65 and 70 d-Thr for new vs. used litter, respectively. Low d-Thr (0.43%) was without effect on most immune parameters. However, low d-Thr decreased relative thymus weight and increased monocyte nitric oxide production in dirty and clean environments, respectively.

Key Words: litter, threonine, immunity

42 Denaturing gradient gel electrophoresis analysis of 16S ribosomal DNA amplicons to analyze changes in ileum bacterial population of turkeys fed different diets and after infection with *Salmonella* spp. A. A. Santos Jr.*¹, P. R. Ferket¹, F. B. O. Santos¹, N. Nakamura², C. Collier², and H. R. Gaskins², ¹North Carolina State University, Raleigh, ²University of Illinois, Urbana.

Non-starch polysaccharides (NSP) and dietary exogenous enzyme supplementation may modulate enteric microflora and discourage *Salmonella* spp. (SAL) colonization by influencing the degree of competitive exclusion. Changes in ileum bacterial populations of SAL-infected turkeys fed different diets were analyzed using polymerase chain reaction (PCR) denaturing gradient gel electrophoresis (DGGE).

Turkeys were fed wheat/SBM- (WS) and corn/SBM- (CS) based diets with and without enzyme preparations (XY1 & XY2, respectively) from 0-126 d. The dietary XY1 and XY2 activity levels were 2500 and 650 EXU/kg feed, respectively (Danisco, UK). Microbial DNA was extracted from the ileum content of 16 wk-old turkeys, and 16S rDNA gene was amplified by PCR and analyzed by DGGE. Diversity indexes, including richness (number of species, S), evenness (relative distribution of species, EH) and diversity (Shannon index, H) were calculated. SAL prevalence was determined from fresh fecal droppings collected from each pen. Diversity indexes were associated with changes of SAL colonization of turkey intestine. The WS diets resulted in higher microbial diversity indexes than CS diets (S= 10 vs. 12; EH= 0.9 vs. 0.8; H= 2.2 vs. 1.9, P<.05). Likewise, enzyme supplementation stimulated the growth of the overall microflora and increased the diversity indexes in comparison to unsupplemented treatments (S= 13 vs. 10; EH= 0.9 vs. 0.8; H= 2.2 vs. 1.9, P<.05). SAL prevalence was higher (P<.05) in turkeys fed the CS diet (50%, 13%) than the corn-enzyme (13%, 0%) and WS (0%, 0%) dietary treatments at 15 and 18 wk, respectively. Therefore, birds fed the CS diet had lower microflora diversity but higher SAL prevalence than birds fed enzyme-supplemented and WS diets. In contrast, birds fed the WS diets had higher diversity but lower SAL prevalence than CS diets. Evidently, high dietary NSP from wheat, and dietary exogenous enzyme supplementation promoted microbial community diversity and discouraged *Salmonella* colonization through competitive exclusion.

Key Words: microbial ecology, *Salmonella*, fiber

43 Modern broilers have a reduced innate immune response compared to random-bred strains when challenged *In Vitro* with *E. coli*. R. D. Kirschenman*, M. Sung, J. Hottman, J. Gallegos, J. L. Saunders-Blades, and D. R. Korver, *University of Alberta, Edmonton, AB, Canada.*

The capacity of the innate immune system of broiler chicks to respond to *E. coli* was examined using three strains of broilers; a modern commercial strain (Ross 308), and two random-bred strains (random-bred since 1977 or 1957). Birds from each strain (n = 30) were bled at 1 day of age and the *in vitro* activity of phagocytic cells for, *E. coli* phagocytosis, and total *E. coli* bactericidal activity, as well as oxidative burst of heterophils were measured. For each strain, a minimum of 87 birds were divided among 8 cages per strain in a battery brooder and grown to 2 weeks of age. The body weight, gain and feed intake of the modern strain were greater than both the 1957 and 1977 strains (P<0.0001), whereas the gain:feed was only greater than that of the 1957 strain (P < 0.0001). The 1977 strain had greater body weights (P < 0.0001), feed intake (P = 0.0059), gain (P = 0.0026) and gain:feed (P = 0.0003) than the 1957 strain. *E. coli* uptake per phagocytic cell was not affected by strain, however both the 1957 and 1977 strains had greater total *E. coli* bactericidal activity than that of the control strain (P < 0.002). The heterophils of the 1957 birds also showed a greater capacity for oxidative burst than either the 1977 or modern strains at 5 (P < 0.0052), 10 (P < 0.0215) and 15 (P < 0.0002) minutes of incubation, and more than the modern strain at 20 minutes (P = 0.0172). These results suggest that although genetic selection for growth has increased the production traits of modern broilers it may have also decreased the effectiveness of the innate immune system when compared to random bred strains. As such, this could have important implications on the future of disease prevention in the broiler industry.

Key Words: broiler, innate immunity, random-bred

44 Effect of PrimaLac®, direct fed microbial, on ileal absorption, energy expenditure and intestinal microbial fermentation. M. Chichlowski*¹, W. J. Croom¹, M. A. Froetschel², M. D. Koci¹, B. M. McBride³, R. Qiu¹, and L. R. Daniel¹, ¹North Carolina State University, Raleigh, ²University of Georgia, Athens, ³University of Guelph, Guelph, ON, Canada.

Previous studies with PrimaLac®, a direct fed microbial (DFM), have demonstrated decreases in whole body and ileal energy expenditures in broilers. This study examined the effects of DFM and salinomycin on ileal glucose and proline absorption and their relationship to GI energy expenditures. GI fluid digesta fermentation products were also measured. In Trial 1, broiler (n=36) were fed a standard starter diet (CON), Con + DFM (PrimaLac®:0.3% w/w), and Con + Salinomycin (SAL;0.05% w/w) from hatch to 3 wk. On d 21, birds were euthanized, ileal tissue dissected and glucose and proline uptake estimated. In adjacent tissue, total O₂ (TO₂) and Na/K ATPase-sensitive O₂ consumption (ATPO₂) were estimated. Trial 2 was similarly designed except jejunal, ileal and cecal fluids were collected for VFA and D/L lactate analysis (n=54). Treatment did not change active ileal glucose or proline uptake. Passive and total glucose and proline uptakes were increased (p<0.07) by DFM compared to SAL. TO₂ and ATPO₂ did not change with treatment. However, the percentage of total ileal cell O₂ consumption attributed to ATPO₂ increased (44%; p<0.04) with SAL. Apparent energetic efficiency of total glucose and proline uptakes were increased (p<0.10) by DFM compared to CON. L-lactate and total lactate concentrations in GI fluid decreased (p<0.01) with DFM compared to CON and SAL while D-lactate increased (p<0.04) with DFM compared to CON. Overall the ratio of L/D lactate did not change amongst treatments. Total cecal VFA concentration was lower (p<0.003) with DFM compared to CON. Total VFA concentrations in jejunum and ileum were not different between treatments. Increases in the efficiency of nutrient absorption and decreases in intestinal fermentation with DFM may contribute to previously observed decreases in energy expenditures; however, these contributions are relatively minor, indicating that other physiological mechanisms are involved.

Key Words: direct fed microbial, broiler, intestinal function

45 Beneficial effects of dietary *Bacillus subtilis* C-3102 spores (CALSPORIN®) on broiler breeder egg production and hatchability in Brazilian trials. D. M. Hooge*¹, M. Kato², M. Hayashi², H. Miyazaki², and K. Maruta², ¹Hooge Consulting Service, Inc., Eagle Mountain, Utah, ²Calpis Company, Ltd, Tokyo, Japan.

Dietary *Bacillus subtilis* C-3102 spores (Bs) from the direct-fed microbial CALSPORIN® (marketed by Quality Technology International, Inc., Elgin, IL in the U.S., Canada, and Mexico) helps maintain normal intestinal microflora and may enhance performance of broiler breeder chickens. As Bs spores vegetate in the relatively short intestinal tract and deplete the oxygen supply within the digesta, they create a more favorable, anaerobic condition that promotes the proliferation of lactic acid producing bacteria (e.g., *Lactobacillus reuterii*). Lactic acid inhibits certain pathogens such as *E. coli*, *Salmonella*, *Clostridia*, and *Campylobacter*. In Exp. 1 at Granja-P Estado de Sergipe, Brazil, Hubbard hens (~12,900/house; 3 houses), 23 or 24 wk of age initially, were fed diets containing an antibiotic (CON; 2 houses) or 0.003% Bs spores (300,000 cfu/g feed; 1 house) to 65 or 66 wk of age (41 to 43 wk total). By treatments, eggs/hen were 173.21 for CON vs 176.32 for Bs spores diets (not analyzed statistically). Eggs hatched/hen were 120.80

vs 128.00, and chicks sold/hen were 120.07 vs 127.22, respectively. The veterinarian reported improved egg shell quality and decreased incidence of cracked and broken eggs due to dietary Bs spores as well. In Exp. 2 at a commercial broiler breeder farm in Brazil, diets were supplemented either with an antibiotic or 0.003% Bs spores (300,000 cfu/g feed) from peak egg production until 65 wk of age. There were 10,000 hens/house x 3 houses/treatment (30,000 hens/treatment). Feed was steam pelleted. Hen-day egg production averaged 86.06% in antibiotic-fed flocks and 87.85% in Bs spores-fed flocks ($P < 0.05$). Eggs/hen averaged 181.14 in antibiotic-fed flocks and 185.03 in Bs spores-fed flocks ($P < 0.05$). It was concluded that dietary Bs spores (0.003% level) may improve hatchability of broiler breeder eggs, compared to unsupplemented diets, similar to antibiotic supplemented diets. Likewise, broiler breeder egg production may be improved by Bs spores diets compared to antibiotic supplemented diets.

Key Words: *Bacillus subtilis* C-3102, broiler breeders, CALSPORIN

46 Effect of Bio-Mos in replacement pullets and layers. R. J. Balander*, *Michigan State University, East Lansing.*

1500 day old Lohmann pullet chicks were divided into 2 groups of 750. One group was fed Bio-Mos in the diet through 18 weeks of age and the other group was fed control pullet feed without Bio-Mos. At 18 weeks of age, 1440 of the birds were moved to the laying cages. During the laying phase of the trial, 360 of the laying hens fed control feed as pullets were fed control feed as layers. 360 laying hens fed control feed as pullets were fed layer feed with Bio-Mos. 360 laying hens fed Bio-Mos feed as pullets were fed layer feed with Bio-Mos and 360 laying hens fed Bio-Mos feed as pullets were fed control layer feed (4 Treatments). Each of the groups of 360 birds were divided into 6 reps of 60 birds. One flat of 30 eggs was collected every 3 to 4 weeks from each of the 24 experimental groups (4 trts x 6 reps/trt). Egg weight was not significantly different between any of the four treatments, however there was a significant increase in egg weights over time. Weekly egg production was not significantly different between any of the treatments, but did decrease significantly over time. And, average specific gravity was not different between any of the treatments, but did decrease significantly over time.

Key Words: Bio-Mos, layers, specific gravity

47 Effects of MOS and avilamycin on broiler performances and carcass yield. M. Haj Ayed¹, A. Bessadok^{*2}, and M. A. Jarraya¹, ¹*Ecole Supérieure d'Horticulture et de l'évage, Chott Mariem, Sousse, Tunisia*, ²*Société Tunisienne d'Aviculture, Borj Cédria, Rades, Tunisia.*

Probiotics and prebiotics are being used to replace antibiotics as feed additives in animal nutrition in order to improve production levels without compromising animals' health. The purpose of this study was to compare the effects of supplementing broiler diets with Mannan Oligosaccharide (MOS) or Avilamycin (AV) on birds' performances and carcass yield to standard (control) diets. Twelve groups of 1 day of age (DOA) Arbor Acres chicks (100/group) were allotted randomly to 3 treatments T1, T2, and T3 (with 4 replications x 100 /treatment).

Chicks were fed diets with MOS (DMOS) in T1, with AV (DAV) in T2, and received control diets (C) with neither MOS or AV in T3. Data were collected on body weight (BW), average daily gain (ADG), feed conversion ratio (FCR), and mortality rate (MR) during the 1 to 36 DOA fattening period. At the end of the trial (36 DOA), 60 broilers (5 broilers/group) were randomly chosen and slaughtered to evaluate carcass yield (CY). Growth performance data showed that broilers receiving diet C had the lowest ($p < 0.05$) ADG (49.5 g/day) among all groups. BW of birds (1777 to 1779g) and FCR did not vary with the regimen ($p > 0.05$). MR was also comparable ($p > 0.05$) among all groups and averaged 3.25, 3.75, and 5.75% for broilers receiving DAV, DMOS, and C diets, respectively. CY varied between 75.4 and 69.7%. The highest value ($p < 0.05$) was observed for DAV birds while intermediary values (71.3%) were observed for the DMOS groups of birds. It should be possible to improve average daily gain and carcass yield by incorporating AV in broiler diets and that MOS might substitute AV.

Key Words: broiler, avilamycin, MOS

48 Responses to lysine levels in broiler chickens fed mannan oligosaccharide and yeast as an alternative to antibiotic growth promoters. S. Gomez* and M. L. Angeles, *National Center for Research in Animal Physiology - INIFAP, Ajuchitlan, Queretaro, Mexico.*

An experiment was done to evaluate the productivity, carcass yield and nutrient balance in broiler chicks fed two levels of lysine (LYS) with and without the provision of mannan oligosaccharide from *Saccharomyces cerevisiae*] combined with dried yeast (MOS+YEA) and with or without flavomycin and monensin (F+M). One hundred and thirty two Ross B300 males from 35 to 49 days of age were assigned to individual holding crates in a complete block design to eight treatments in a factorial arrangement of 2 F+M levels (0,0 and 50,500 ppm/ton of feed) x 2 MOS+YEA levels (0 and 1 kg/ton of feed of yeast hydrolyzed fermentation solubles and hydrolyzed brewers dry yeast:) x 2 digestible LYS levels (.85 and .95%). With F+M, weight gain (77.0 vs 81.0 g/d, SEM=2.590; $P < .05$), feed efficiency (.418 vs .446, SEM=.0068; $P < .01$) and ashes excretion were higher (2.9 vs 3.2 g/d, SEM=.073; $P < .05$), and the ashes retention was lower (77.4 vs 74.8 %, SEM=.907; $P < .05$). With MOS+YEA, body weight gain (76.3 vs 81.6 g/d, SEM=1.576; $P < .05$), weight and yield of carcass (1099.1 vs 1190.2 g, SEM=23.987; $P < .01$ and 42.9 vs 46.4 %, SEM=.937, $P < .01$), weight and yield of breast (450.9 vs 497.7 g, SEM=11.532; $P < .01$ and 17.6 vs 19.4 %, SEM=.450; $P < .01$), weight and yield of thighs (328.7 vs 349.9 g, SEM=7.445; $P < .05$ and 12.8 vs 13.6 %, SEM=.291; $P < .05$), weight and yield of drumsticks (204.7 vs 220.6 g, SEM=4.124; $P < .01$ and 8.0 vs 8.6 %, SEM=.161; $P < .01$), retention of dry matter (89.8 %, SEM=.353; $P < .05$), organic matter (89.8 vs 90.7 %, SEM=.316; $P < .05$) and ashes (75.0 vs 77.2 %, SEM=.893; $P < .05$) were improved. At a dietary LYS level of .95, feed efficiency was improved (.421 vs .441, SEM=.0068; $P < .05$). In summary, broiler chickens fed F+M or MOS+YEA did not respond to the supplementary provision of LYS; chicks fed MOS+YEA showed the greatest benefits on growth, carcass yield and nutrient retention and could be an alternative to antibiotic growth promoters.

Key Words: broiler, antibiotic, *Saccharomyces cerevisiae* cell wall

49 Assessing liver energy metabolism of late term turkey embryos using microarrays. J. de Oliveira*¹, P. Ferket¹, C. Ashwell¹, and Z. Uni², ¹North Carolina State University, Raleigh, ²Hebrew University of Jerusalem, Rehovot, Israel.

Poultry embryos depend on lipid-based energy metabolism (MT) during most of their development, but must shift to a carbohydrate-based MT dependant on glycogen reserves likely when hatching and pulmonary respiration begins. For glycogen reserves to accumulate and fuel hatching activity, gluconeogenic MT must be expressed. Our objective was to survey the time course and degree of expression among 90 genes associated with lipid and carbohydrate (CHO) MT at 20, 22, 24, 26, and 28 d of incubation (E) of turkeys, using microarrays (MA). At each time point, liver samples were collected, from 25 Nicholas turkey embryos, to extract RNA to produce fluorescently labeled cDNAs for MA hybridization. MA were printed with specific 70 bp oligonucleotides designed for each of the 90 genes. Six genes that code for key enzymes of metabolic regulation were selected: enoyl-CoA hydratase/3-hydroxyacyl-CoA dehydrogenase (EHD), glucokinase (GK), phosphoenolpyruvate carboxykinase (PEPCK), citrate synthase (CS), glycogen synthase (GS) and glycogen phosphorylase (GP). Gene expression (GE) data for each time point were interpreted relative to E28 GE levels (set to 100%). Lipid MT was apparently reduced at E22, indicated by change in EHD GE of 20% above E28 levels at E20 ($p < 0.0001$) to 9% below at E22 ($p < 0.05$). Glycolysis was apparently down regulated at E24 and E26, as GK GE decreased 10 and 13%, respectively ($p < 0.05$). Gluconeogenesis was apparently down regulated only at E22, when PEPCK GE was suppressed by 15% ($p < 0.0001$). Glycogen synthesis and breakdown GE increased transiently from E20 to peak at E26, as GS and GP changed from 20% below to 20% and 30% above E28 GE, respectively ($p < 0.0001$). Likewise, CS GE, the key enzyme to control TCA cycle activity and energy usage, increased transiently from 30% below E28 GE ($p < 0.0001$) at E20 to 20% above E28 at E26 ($p < 0.0001$). Evidently, the shift from lipid to CHO MT initiates at E22, but storage and usage of CHO seems to gradually increase until E26, which corresponds to the time of internal pipping.

Key Words: turkeys, energy metabolism, microarrays

50 Lipid yolk utilization of late term broiler embryos. Z. Uni* and N. Argov, Faculty of Agriculture Hebrew University, Rehovot, Israel.

Yolk biochemical analysis during last period of incubation revealed changes in the protein; lipid weight ratio from 1.2 on day 17 E to 4.3 on day of hatch. This indicate intensive uptake of yolk lipid fraction and imply preferential use of the lipid, rather than the protein fraction of the yolk, in the late term embryo. In order to determine which portion of the yolk lipid fractions is required by the embryo, fatty acids profile and cholesterol concentration within the yolk were examined during the pre-hatch period in Ross embryos. The results indicated decreased cholesterol concentration toward hatch; differential uptake of the different fatty acids in the yolk as poly-unsaturated fatty acids (PUFA) concentration decreased from 23% of total fatty acids at day 17 of incubation, to 19% at hatch ($P < 0.05$) and saturated (SAT) fatty acids concentration increased from 30% to 34% of total fatty acids at hatch ($P < 0.05$). The results imply existence of a specific mechanism which enables the yolk sac membrane to transfer specific lipid fractions. Therefore, our further studies were focused on examining the mRNA expression of 1) lipoprotein lipase (LPL), which enables fatty acids

utilization, and 2) low density lipoprotein receptor (LDLR) which enables lipoprotein uptake (by endocytosis) from the yolk to the yolk sac membrane cells.

Results showed that LPL mRNA expression decreased in 20 E and remained low at hatch, in comparison to its expression levels at 17 E, 18 E and 19 E ($P < 0.05$). However, an increase was found in the LDLR mRNA expression levels by approximately 3 folds in 20 E, in comparison to 17 E, 18 E and 19 E ($P < 0.05$). These differences in mRNA expression patterns of LPL and LDLR, implies that the dominant pathway by which lipid fraction are utilized by the yolk sac membrane is turning from individual fatty acid transport, as facilitated by LPL, to whole lipoprotein uptake, by LDLR.

Additional identification of the genes enabling lipid utilization, and characterization of the lipid fractions utilized by the embryonic throughout the late embryonic period will clarify the embryonic needs at the pre-hatch period and the possible interaction with conditions in the hatchery.

Key Words: broiler embryo, yolk, fat

51 Hatchery feeding of starter diets to broiler chicks. M. T. Kidd*¹, J. W. Taylor², C. M. Page¹, B. D. Lott¹, and T. N. Chamblee¹, ¹Mississippi State University, Mississippi State, ²Tyson Foods, Incorporated, Forest, Mississippi.

Research reports concerned with amino acid density and *in ovo* feeding have delineated the importance of early nutrition of broilers. Eggs from a Cobb x Cobb 500 slow-feathering cross were set in a common incubator and hatched. Chicks were feather-sexed, placed in 36 chick trays (25 chicks of each sex), and weighed by tray. One of four dietary treatments were administered (454g/tray) in crumble form: 1) no feed; 2) feed containing 1.24% digestible (d) Lys, 0.84% d TSAA, 0.80% d Thr, 23.2% CP, and 3,080 kcal/kg ME; 3) feed containing 1.45% d Lys, 0.94% d TSAA, 0.84% d Thr, 26.0% CP, and 3,080 kcal/kg ME; 4) as 3 plus 100 mL of potable water added to the crumbles five min before administration in the trays. Chicks received feed treatments in trays until placement (5 h total tray feeding). Chicks were placed in floor pens in a curtain-sided, tunnel-ventilated house by trays (50 chicks/pen) containing one tube feeder, nipple drinkers, and built-up litter (average litter temperature of 51 C under the brooder at d 1). All birds received common diets in pens from 1 to 17 d in crumble form, and 18 to 28 and 29 to 37 d in pellet form. BW by pen was measured on d 7, 17, and 37, and feed intake on d 1 to 17 and 1 to 37 for live performance measurements. Three birds from each sex per pen were chosen randomly for processing at d 37. Bird measurements at 37 and 38 d consisted of duodenum and jejunum wet weight, processing weight, foot paw score, carcass weight, abdominal fat weight, breast weight (fillets and tenders), wing weight, thigh weight, and drumstick weight. Pen was used as the experimental unit for all statistical analyses. Chicks receiving treatment 4 (140 g/bird) hatchery feed had higher d 7 ($P = 0.02$) BW gain than chicks receiving treatment 2 (137 g/bird) or 1 (136 g/bird). But chicks receiving treatments 2 and 3 had similar ($P > 0.05$) d 7 BW gain. Additional parameters measured did not differ ($P > 0.05$). Results indicate that pre-placement feeding for 5 h of the crumbled starter diets presented herein (as-is or wet) does not result in benefits for Cobb 500 broilers grown to 2.1 kg (straight-run average BW).

Key Words: hatchery feeding, amino acid, broiler

52 Effect of dietary gelatin supplementation on early intestinal development and performance of broiler chicks. Y. O. Fasina^{*1}, E. T. Moran¹, C. M. Ashwell², D. E. Conner¹, and S. R. Mckee¹, ¹*Auburn University, Auburn, Alabama*, ²*North Carolina State University, Raleigh*.

The intestine of poultry is not fully developed at hatch. One way to induce early intestinal development and digestive function in young poultry is through the inclusion of feed ingredients that can increase ribosomal capacity for translating amino acid to protein (protein:RNA) and the expression genes coding for brush border enzymes involved in membrane digestion of nutrients. Gelatin is an ingredient that contains a high level of protein (about 80%). Therefore, supplementing gelatin at 2% level of broiler chick starter diet may induce early intestinal development. A 14-day experiment was conducted using 144 day-old chicks obtained from a commercial hatchery. Chicks were randomly allocated to 2 treatments; treatment 1 (SB) in which chicks were fed a gelatin-free corn-soybean meal (SBM) diet, and treatment 2 (SBG) in which chicks were fed a gelatin-supplemented corn-SBM diet. Each treatment consisted of 4 replicate pens, with each pen containing 18 chicks. On day 7 of experiment, performance parameters of chicks (weight gain and feed conversion (FC)) were recorded. Also, intestinal tissue samples were collected (from jejunum) and analyzed for protein:RNA. The expression level of selected brush border enzymes (leucine aminopeptidase (LAP) and sucrase isomaltase (SIM)) in the jejunal tissues was also evaluated using the Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR) procedure in which the expression of each gene was determined relative to that of a housekeeping gene (GAPDH or β actin). On day 14, only weight gain and feed intake was evaluated. Results showed that during the first week, the FC of chicks in the SBG treatment (1.12) was superior ($p < 0.05$) to the FC of chicks in the SB treatment (1.26). However, by day 14, chicks in both treatments had similar FC values. Protein:RNA ratio was also superior ($p < 0.05$) for chicks in the SBG compared to chicks in the SB, but there was no difference in the expression of LAP and SIM genes. It was concluded that supplementing broiler chick starter diets with 2% gelatin induced early intestinal development and enhanced FC during the first week of life.

Key Words: gelatin, broiler chicks, gene expression

53 The effect of varying period and severity of early food restriction on performance and carcass quality of two broiler strains. M. R. Bakhtiari, K. Nazer Adl, and H. Janmohammadi*, *University of Tabriz, Tabriz, East Azarjan, Iran*.

Effect of two periods of early food restriction (7 or 14 days) and four level of food restriction severity (0,30,40, and 50 percentage of voluntary feed intake of control groups) on weight gain, feed conversion ratio, dressing percentage and abdominal fat in two mixed-sex of Ross and Arian broiler strains were studied in completely randomized design as factorial method analysis. Food restriction regimes were started from 7- days of age. Main effects of period of food restriction was significant ($P < 0.05$) on body weight gain (BWG) in week 3, but BWG, feed conversion ratio (FCR), dressing percentage and abdominal fat were similar in two period of food restriction (7 or 14 day) in 8-56

days of age. With increasing of severity of food restriction from 0 to 50 percentage, BWG decreased significantly ($P < 0.05$) from 135 to 83.5 gm in week 3. In period of 8-56 days of age, the highest value of BWG was resulted with 30 percentage of food restriction severity. FCR and carcass qualities were not affected by food restriction severity treatments. The interaction between food restriction severity and broiler strains was significant ($P < 0.05$) on BWG and FCR in 8-56 days of age. BWG and FCR values were better in Arian broilers than those in Ross ones. BWG and FCR were similar in all food restriction severity treatments for Arian broilers, but the highest value of BWG and the lowest value of FCR were obtained with 30 percentage of food restriction severity for Ross broilers in 8-56 day of age. The interaction between period of food restriction and broiler strains was significant ($P < 0.05$) on BWG and FCR in 8-56 days of age. The period of food restriction had more negative effects on BWG and FCR of Ross broilers in comparisons to Arian ones. The best value of FCR was resulted in period of 14 days for Arian broilers.

Key Words: early food restriction, broiler strains, performance

54 A new natural feed additive for broiler chickens. F. Saleh^{*1}, M. Yamamoto¹, M. Tahir², A. Ohtsuka², and K. Hayashi², ¹*Biogenkoji Research Institute, Kirishima city, Mizobe, Japan*, ²*Kagoshima University, Biochemical Science and Technology, Kagoshima city, Korimoto, Japan*.

Supplementing exogenous enzymes, growth promoters or microorganisms to the broiler diet is widely used to improve broiler performance. In the present study, an experiment was conducted to study the effect of a new commercial feed additive Tomoko[®] on performance in broilers. Tomoko[®] is a feed additive produced by fermentation using Koji (*Aspergillus awamori*), containing enzymes and active *Aspergillus awamori* mycelium. Male broiler chicks (Cobb strain) were raised under 25 °C in wire bottom cages for 12 days from 15 days of age. Chicks were divided at 15 days of age into control (C), 0.05 % Tomoko[®] (T) and 0.05 % heated (85 °C, 1 min) Tomoko[®] (HT) groups with 7 replicates. The basal diet (CP 21.1%, ME 3000 Kcal/kg) was made mainly from corn and soybean meal and Tomoko[®] was mixed into the basal diet. Feed and water were offered ad libitum. Body weight was recorded every 3 days and feed intake recorded daily. At 27 days of age, all the birds were killed by decapitation and dissected to measure carcass yield. The data were analyzed through the analysis of variance (ANOVA), using a general linear model procedure of the statistical analysis system with Duncan's multiple range test. The result showed no significant effect of T and HT on body weight gain. However, birds receiving diets supplemented with Tomoko[®] significantly consumed less feed compared to C group (C:1123g, T:1004g, HT:1044g) and feed conversion ratio was significantly decreased by Tomoko[®] (C:1.60, T:1.39, HT:1.49). Also, Tomoko[®] showed significant improvement in carcass yield (g/100g BW) (C:68.6, T: 70.0, HT:70.4). Interestingly, no significant differences were observed between T and HT groups in performance and carcass yield. It is concluded that Tomoko[®] is effective to improve the performance of broiler when fed corn soybean meal diet and the effectiveness was not affected by the heat treatment.

Key Words: broiler, performance, Tomoko