

ABSTRACTS
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M1 Effect of dietary cottonseed meal and lysine on some reproductive parameters of male broiler breeders. F. Mahmood*, Z. Khan, A. Khan, and G. Muhammad, *University of Agriculture, Faisalabad, Pakistan.*

Objectives of this study were to explore the untoward effects of cottonseed meal (CSM) on male reproductive performance of broiler breeders and ameliorating effects of lysine addition in rations. A total of 80 broiler breeder males of 40 weeks of age were divided into 8 groups. The four groups were fed diets containing CSM @ of 0, 10, 20 and 30%, respectively. The remaining four groups were given same diets with the supplementation of 2% lysine. Duration of the experiment was 10 weeks. Body weight, comb area, vent length, semen volume and sperm counts were determined weekly. A significant decrease in body weight, comb area and vent size was observed in 20 and 30% CSM fed groups compared to control group. A decrease in serum testosterone, semen volume and sperm counts occurred with the increase in dietary level of CSM. Testes volume, absolute and relative weights were significantly lower in all the groups as compared to control birds. No pathological lesions were observed in testes of males kept on ration containing up to 20% CSM fed groups. Testes of males of group given 30% CSM showed increased connective tissue proliferation in the intertubular spaces. In most of the tubules round spermatids had necrotic nuclei. In some birds seminiferous tubules had smaller diameter than those of birds of control group and were lined with 1-2 layers of cells having vesicular nuclei with a nucleolus and fine chromatin.

No or partial amelioration of the adverse effect of cottonseed meal was observed upon parameter related to reproductive system like testes size, testes weight, volume, semen volume, sperm count and serum testosterone level. Similarly histopathologically only partial or no amelioration was observed by adding of lysine along with CSM.

It was concluded from the study that 10% CSM incorporated in diets of broiler breeder males was found with out adverse effects on the reproductive performance. Lysine supplementation in the ration only partially alleviated the deleterious effects produced by cottonseed meal.

Key Words: Cottonseed meal, Male broiler breeders, Semen, Testes, Pathology

M2 Evaluating the thermostability of *Bacillus subtilis* PB6 under commercial pelleting conditions. S. Moore* and Y. Lao, *Kemin Industries, Des Moines, IA.*

Research studies were conducted at Kansas State University (Manhattan, KS) to evaluate the thermostolerance of a proprietary/patented microorganism when exposed to challenges encountered during commercial pelleting processes. Mash

feed was inoculated with CloSTAT™ brand Direct-Fed Microbial (CloSTAT) – a blend of *B. subtilis* PB6 and inert carriers – to attain a concentration of 10¹⁰ spores/T feed. Two studies using treatment x temperature factorial designs were conducted in triplicate. In Study One, mash feed was exposed to conditioner temperatures set at 70, 80 or 90°C prior to pelleting. In Study Two, conditioned feed (82°C) was processed through an annular gap expander prior to pelleting. Thermostolerance was determined via a plate count method incorporating measures selective for *Bacillus sp.* recovery. In both studies, differences were observed between non-inoculated and inoculated mash feed (P<0.05, Study One; P<0.001, Study Two) verifying that the targeted levels of PB6 were achieved. In Study One, hot pellet temperatures ranged from 78.8 – 89.1°C and, in Study Two, hot pellet temperatures ranged from 92.8 - 98.3°C. As temperatures increased, survivability of the organism decreased (P<0.001, Study One; P<0.05, Study Two). While biological systems are inherently variable, it can be generalized that, when hot pellet temperatures reach ≥90°C, there is a statistical probability that a minimum of 1 log of microorganisms will be lost. The results of the KSU expander study closely paralleled previous work where similar losses were observed under commercial expander/pelleting conditions. A research trial conducted at Southern Poultry Research (Athens, GA) demonstrated that PB6 inoculated into mash feed at 109cfu/T (103cfu/g feed on an as-fed basis) was effective in reducing necrotic enteritis mortality and related production losses.

Key Words: *Bacillus subtilis* PB6, Thermostability, CloSTAT™ brand direct-fed microbial, Pelleting

M3 Effects of supplemental dietary phytase and 25-hydroxycholecalciferol on the performance characteristics of commercial layers inoculated before or at the onset of lay with the F-Strain of *Mycoplasma gallisepticum*. E. D. Peebles*¹, S. L. Branton², M. R. Burnham¹, S. K. Whitmarsh¹, and P. D. Gerard³, ¹Mississippi State University, Mississippi State, ²Poultry Research Unit, Agricultural Research Service, USDA, Mississippi State, MS, ³Clemson University, Clemson, SC.

The effects of dietary supplementation with phytase and 25-hydroxycholecalciferol on the performance characteristics of commercial layers that were inoculated prelay (12 wk of age) or at the onset of lay (22 wk of age) with F-strain *Mycoplasma gallisepticum* were assessed. Experimental layer diets that included a basal control diet or the same diet supplemented with 0.025 % phytase and 25-hydroxycholecalciferol were fed from 20 through 58 wk of age. Weekly and total egg production were determined from 22 through 58 wk, and egg weight, and various internal egg and eggshell quality characteristics were examined at 34, 50, and 58 wk of age. F-strain *M. gallisepticum* inoculation decreased egg production at the beginning of lay (wk 22 and 23), but increased post-peak lay

at wk 45. However, there were no treatment effects of any kind on total egg production, egg weight, or on any of the internal egg and eggshell characteristics examined during lay. In conclusion, dietary supplementation with phytase and 25-hydroxycholecalciferol did not affect layer performance or interact with the effects of F-strain *M. gallisepticum* inoculation; however, F-strain *M. gallisepticum* inoculation resulted in a shift in egg production from the pre- to post-peak period of lay without having an overall effect on total egg production.

Key Words: F-strain *Mycoplasma gallisepticum*, Inoculation, *Mycoplasma gallisepticum*, Phytase, 25-hydroxycholecalciferol

M4 Effects of non-feed removal molting methods on egg quality traits in commercial brown egg laying hens. R. Cibik*, M. Petek, S. S. Gezen, and F. Alpay, *Uludag University, Bursa, Turkey.*

Non-feed removal molting programme in commercial brown laying hens and its influence on pre-molting, post-molting and end of cycle egg quality traits were investigated. Overall 54 birds were randomly divided into three treatment groups and each group was fed one of the following diet: (i) grain barley, (ii) alfalfa meal, or (iii) commercial layer ration (non-molting control group) over 10 days molting period. Eggs obtained from groups in pre-molting, post-molting and end of cycle periods were examined for several quality performance traits such as egg weight, specific gravity, shape index, shell strength, shell thickness, eggshell weight, haugh unit, albumen index, yolk index and yolk color. Results indicated that non-feed removal molting programme that was composed of grain barley diet had positive effect on egg quality traits in laying hens. Particularly, parameters such as yolk color and haugh unit, which are accepted as the most important quality parameters from the consumer point of view were relatively improved in barley molted group.

Key Words: Molting, Alfalfa, Barley, Feeding, Egg quality

M5 *Campylobacter*, *Salmonella* and *E. coli* on broiler carcasses from commercial plants under HIMP inspection. M. E. Berrang* and J. S. Bailey, *USDA-ARS, Athens, GA.*

The objective of this study was to determine the numbers of *Campylobacter* and *E. coli* as well as the prevalence of *Salmonella* on broiler carcasses processed in all commercial processing plants currently being inspected under the HACCP based Inspection Models Project (HIMP) of the USDA-FSIS. In 2006, 20 broiler processing plants were under HIMP inspection. A total of 10 carcasses were collected from each HIMP plant, five from re-hang and five post chill. Sample collection was timed so that the same flock was sampled at each site. All samples were subjected to a whole carcass rinse procedure; a portion of the rinsate was enriched for *Salmonella* detection while serial dilutions were directly plated for *Campylobacter* and *E. coli*. All results are reported as log CFU/mL rinse. *Campylobacter* numbers at re-hang ranged from 0.0 to 3.22 with a mean of 1.57; at post chill these numbers were significantly lower ranging from 0.0 to 0.69 with a mean of 0.04. *E. coli* numbers at re-hang ranged from 2.33 to 4.03 with a mean of 2.88; processing lowered these numbers to between 0.0 and 1.38 with a mean of 0.49 post chill. *Salmonella* prevalence at re-hang ranged from 0 to 100% with a mean of 54%; post chill the prevalence was from 0% to 60% with an average of 11% positive. A similar study was conducted in 2004 which included four of the same HIMP plants. In the current data, the numbers of *Campylobacter* and *E. coli* at re-hang were significantly lower than those recovered in 2004; however, the post chill numbers were not significantly different than the earlier study. These data show that processing broilers in plants under HIMP inspection continues to result in lessening the prevalence and numbers of bacteria on carcasses.

Key Words: *Campylobacter*, *Salmonella*, *E. coli*, HIMP, Broiler

M6 Bacterial flora of skin of processed broilers after multiple washing in potassium hydroxide and lauric acid. A. Hinton, Jr.* and J. Cason, *Russell Research Center, Athens, GA.*

The number of various types of bacteria on skin of processed broilers was determined after each of five consecutive washings in mixtures of potassium hydroxide (KOH) and lauric acid (LA). Breast skin was taken from carcasses obtained from a commercial poultry processing facility. Portions of skin were washed using a Stomacher laboratory blender to stomach skin in distilled water (control) or in mixtures of 0.25% KOH-0.50% LA or 0.50% KOH-1.00% LA. After each wash, skin was transferred to fresh solutions and washing was repeated to provide skins samples washed for 1, 2, 3, 4, or 5 times in each solution. Washed skin was stomached in Butterfield's Phosphate Buffer, and the bacterial flora of the rinsates was enumerated on Plate Count (PC) Agar, Staphylococcus (STA) Agar, Levine Eosin Methylene Blue (EMB) Agar, Lactic Acid Bacteria (LAB) Agar, and Perfringens (PER) Agar with TSC supplement. Results indicated that there was no significant difference in the number of bacteria recovered on PC, STA, EMB, LAB, or PER agars from skin washed 1 or 5 times in water. Significantly fewer bacteria were recovered on PC, STA, and EMB agars from rinsates of skin washed 5 times in 0.25% KOH-0.50% than from skin washed 1 time in this solution. There was no significant difference in the number of bacteria recovered on LAB or PER agars from skin washed 1 to 5 times 0.25% KOH-0.50% LA, however, no bacteria were recovered on LAB agar from rinsates of skin washed 3 or more times in 0.50% KOH-1.00% LA or on PER and EMB agars from rinsates of skin washed 4 or 5 times in this solution. Significantly fewer bacteria were recovered on PC Agar from skin washed 5 times in 0.50% KOH-1.00% LA than from skin washed 1 time in the solution, but there was no significant difference in the number of bacteria recovered on STA Agar from skin washed 1 to 5 times in 0.50% KOH-1.00% LA. Findings indicate that although bacteria can be continually shed during repeated washing of poultry skin, bactericidal surfactants can be used to remove and kill several types of bacteria found on chicken skin.

Key Words: Broilers, Bacterial flora, Processing, Lauric acid, Potassium hydroxide

M7 Omega-3 Enrichment of chicken meat using ground flaxseed: Effect of level and duration on fatty acid composition of triacylglycerols and phospholipids. T. I. Perez*¹, M. Betti¹, M. J. Zuidhof², B. L. Schneider², R. A. Renema¹, V. L. Carney², and D. R. Korver¹, ¹*University of Alberta, Edmonton, AB, Canada*, ²*Alberta Agriculture and Food, Edmonton, AB, Canada.*

Nowadays, consumers are aware of the food impact on their health. Researchers suggest that diets enriched with polyunsaturated fatty acids (PUFA), particularly omega-3 (n-3), could reduce risk of cardiovascular disease. Due to alpha-linolenic acid (ALA) content, flaxseed is a good source for enhancing n-3 fatty acids in poultry meat. However, it is not clear if the enrichment is limited to the adipocytes or if it is also enriching the phospholipids membrane of the muscle cells. A Study was conducted to establish the distribution of n-3 PUFAs between triacylglycerols (TG) and phospholipid fractions (PL). The experiment was a 2 x 8 factorial with two dietary levels of ground flaxseed (10 and 17%) and eight durations of inclusion prior to processing (0 [Control], 4, 8, 12, 16, 20, 24, and 35 d). A total of 656 Ross x Ross 308 mixed-sex broilers were evaluated to 35 d of age. Breast fatty acid composition was analyzed on 128 carcasses. ALA was higher in TG fraction compared to PL fraction (188 vs. 3 mg/100g of meat; P<0.001). After feeding 10 or 17% flaxseed for 16 days, ALA concentration in TG fraction tripled (243 and 242, respectively, vs 74 mg/100 g meat in the control group; P<0.05). No ALA enrichment was found in the PL fraction. n-3 long chain PUFAs (EPA, DPA, DHA) were higher in the PL fraction compared to the TG fraction (23 vs. 5 mg/100g of meat P<0.001). The 17% flaxseed diet increased the n-3 long chain PUFAs levels after 4 days of duration (18 vs 26 mg/100 g of meat; P<0.01), while 24 days with 10% flaxseed were necessary for a significant increase (18 vs 23 mg/100 g meat; P<0.05). Long chain n-3 PUFAs also increased in the TG fraction after 4 days of duration (2.1 vs. 4.7 mg/100 g of meat; P< 0.01).

Key Words: Flaxseed, Phospholipids, Polyunsaturated fatty acids, Alpha-linolenic acid

M8 The effect of low atmosphere stunning and deboning time on broiler breast meat quality. V. Battula*, M. W. Schilling, Y. V. Thaxton, J. B. Williams, J. Behrends, and T. B. Schmidt, *Mississippi State University, Mississippi State.*

A randomized complete block design with three replications (n=432, 72 broilers per treatment) was utilized to evaluate the effects of electrical (ES) and vacuum stunning (VS) on broiler breast meat quality. Electrical stunning was performed by applying 11.5 volts, <0.05 mA, AC to DC current for 3 s for each broiler. Vacuum stunning was accomplished by exposing the birds to low atmospheric pressure of 597 to 632 mm Hg in an air-tight decompression chamber. Breast removal was then performed at 0.75, 2, and 4 h postmortem for each stunning method. Color, pH, cook loss, and shear force values were measured on breasts that were removed from the right side of the carcass. Breasts removed from the left side of the carcass were utilized for consumer acceptability testing. The L* values were lower (p<0.05) for VS than ES at 4 h and 2 h deboning times. On average, 15 min and 24 h pm pH values were not different (p>0.05) for both stunning method and deboning time. Shear force did not differ (p>0.05) between stun methods but decreased (p<0.05) as deboning time increased. On average, no differences (p>0.05) existed in consumer acceptability (appearance, texture, flavor, overall) among breast meat from ES or VS birds that were deboned at 2 or 4 h. However, consumers could be clustered into 8 groups based on preference and liking of samples regarding overall and texture acceptability. Sixty-five percent of consumers (3 clusters) liked all broiler breast treatments. Within these three clusters, some consumers preferred (p<0.05) 4 h deboned samples over those deboned at 2 h (Cluster 7), and other consumers preferred (p<0.05) those deboned at 2 h over 4 h samples (Cluster 6). Data reveals that both stunning methods provide high quality breast meat with minimal product differences.

Key Words: Electrical stunning, Vacuum stunning, Deboning time, Breast meat quality, Consumer acceptability

M9 Developmental changes in enterocyte morphology in the small intestine of avian embryos. D. M. Karcher*¹ and T. J. Applegate², ¹*Michigan State University, East Lansing*, ²*Purdue University, West Lafayette, IN.*

This study evaluated the formation of tight junctions in the small intestinal segments of the chicken, duck, and turkey in the final days of incubation and initial days post-hatch. Embryos (3) were sampled every other d from d 14 for chicken and d 18 of incubation for duck and turkey through 7 d post-hatch. All 3 segments of the small intestine were collected, fixed, and embedded for transmission electron microscopy. Measurements of tight junctions and enterocyte morphology were evaluated in the jejunum on days -7, -4, 0 (hatch), 1, 3 with the duodenum and ileal samples evaluated at day of hatch in all 3 species. Four micrographs were taken in the crypt and villus tip of each segment resulting in 8 micrographs used for measurements. Jejunal enterocyte membrane percentage (EMP) involved in tight junctions decreased (25%) from d -7 to hatch increasing (15 to 40%) post-hatch. No difference in EMP was observed across species or intestinal segments at day of hatch. However, the EMP is influenced by enterocyte size. The jejunal microvillus length changes during development with chicken and duck increasing (350%) in microvillus length from d -4 to d 3 post-hatch while that in the turkey is negligible (6%). The microvillus length on the villus tip increases following hatch while the crypt microvillus length remains static regardless of the small intestinal segment. The observations made in cellular structure and morphology are similar to reports by other researchers, but this is the first report of those observations in both duck and turkey. Potential for "embryonic" enterocytes exist with appearance of a goblet cell originating along the basolateral membrane and extruding enterocytes at d of hatch. The tight junctions appear to be ensconced by d of hatch with little change in cell perimeter in the next 24 hr. Therefore, tight junctions are structurally sound by d of hatch but further investigations need to evaluate the functionality during this time period.

Key Words: Chicken, Duck, Turkey, Small intestine, Tight junction

M10 Gonadotropin and steroid hormone regulation of the activin type IIA and IIB receptors in cultured granulosa cells from broiler breeder hens. B. M. Stevens*, M. E. Freeman, and A. J. Davis, *University of Georgia, Athens.*

Previous research suggests that the activin family of hormones have regulatory roles in chicken follicular development. Activin^{CTMs} cell surface receptor complex consists of an activin type I receptor (ActRI) and an activin type II receptor (ActRII). Previously, we determined the expression pattern of the mRNA for the activin receptors in the theca and granulosa cells of the preovulatory follicles of the broiler breeder hen. In the current research, gonadotropin (LH and FSH) and steroid hormone (estradiol and testosterone) regulation of the mRNA expression of the two forms of the ActRII receptor (ActRIIA and ActRIIB) was investigated in cultured granulosa cells, isolated from the F1, F3, or small yellow (SY) follicles from three broiler breeder hens for each replicate experiment. Isolated and dispersed granulosa cells from each follicular size were cultured for 24 hours in the absence or presence of 50 ng/mL of culture media of LH or FSH (5 replicate experiments), or in the absence or presence of 1×10^{-6} M testosterone or $17\text{-}\beta$ estradiol (5 replicate experiments). Total RNA was extracted from all the cultured granulosa cell samples for subsequent real-time RT-PCR analyses of ActRIIA, ActRIIB and GAPDH (endogenous control) mRNA expression using gene specific primer pairs and a Taqman minor groove binding probe for each gene. Testosterone significantly depressed the mRNA expression of ActRIIA in the granulosa cells from all three follicle sizes. Estradiol had no effect on the mRNA expression of either ActRII except for inhibiting the mRNA expression of ActRIIB in granulosa cells isolated from SYF. The addition of LH or FSH to the cell culture media significantly lowered the expression of both ActRIIA and ActRIIB in the granulosa cells from all follicle sizes, with the exception of F1 granulosa cells in which FSH did not significantly depress the mRNA expression of ActRIIB. The results suggest that the presence of LH, FSH and testosterone in vivo may decrease the sensitivity of granulosa cells to activin.

Key Words: Activin, Chicken, Follicle

M11 Expression of the mRNA for zona pellucida protein B2 in the developing follicles of the broiler breeder hen. M. N. White*, M. E. Freeman, and A. J. Davis, *University of Georgia, Athens.*

The freshly ovulated ovum in avian species is surrounded by a protein layer called the inner perivitelline layer (IPVL), which is equivalent to the zona pellucida in mammals. For successful fertilization, sperm must attach and penetrate the IPVL. In the domestic chicken six distinct zona pellucida genes have been identified (ZPA, ZPB1, ZPB2, ZPC, ZPD and ZPX). In the present research, the expression of the mRNA for ZPB2 was investigated in theca and granulosa cells of the developing preovulatory follicles of 8 broiler breeder hens. Individual theca and granulosa layers were isolated from the F1-F4 follicles. Theca and granulosa cells were enzymatically separated from one another in the nonhierarchical follicles which were pooled by size in the following categories less than 2 mm, 2-5 mm, 5-8 mm and 8-12 mm in diameter. The isolated theca and granulosa cells from each follicle size from two birds were combined to create four replicate samples for each follicle size. Total RNA was extracted from the samples and DNase treated for two step real-time PCR analyses of ZPB2. Taqman minor groove-binding probes and primers for detecting ZPB2 and GAPDH (endogenous control) were designed using Primer Express (Version 2.0, Applied Biosystems) based on published nucleotide sequences of these genes. Granulosa cell expression of ZPB2 was highest in the less than 2 mm sized follicles, followed by the 2-5 mm diameter and F4 follicles. Expression of ZPB2 in the F2 and F3 follicle was lower than the expression found in the F4 follicle. Interestingly, ZPB2 mRNA was not detected in the granulosa cells isolated from the F1, 5-8 mm, or 8-12 mm sized follicles or in any of the theca samples from the hierarchical follicles. Significant theca cell expression of ZPB2 was detected in the theca cells from the smallest follicles. The results suggest that unlike ZPC and ZPD which are known components of the IPVL and which have high mRNA expression only in granulosa cells from the largest hierarchical follicles, that ZPB2 may have a role in early follicle development.

Key Words: Zona pellucida, Chicken

M12 Ghrelin and reproduction in the broiler breeder hen. M. E. Freeman* and A. J. Davis, *University of Georgia, Athens.*

Ghrelin is a hormone produced predominantly in the proventriculus of birds in response to energy status. There are two forms of circulating ghrelin, unacylated ghrelin (UAG) and acylated ghrelin. The two forms share the same amino acid sequence but UAG undergoes an acylation of its third amino acid residue to become acylated ghrelin which can bind to the ghrelin receptor (GHSR). There is increasing evidence that ghrelin directly affects reproduction in mammalian species. Previously we reported that GHSR mRNA was expressed in both the theca and granulosa cells of the preovulatory follicles of the broiler breeder hen ovary and that fasting increased GHSR mRNA expression in the theca cells. The goal of the current research was to determine if plasma levels of total or acylated ghrelin increased in fasted broiler breeder hens and if ghrelin influenced progesterone (P4) production in cultured granulosa cells. Blood samples were collected from hens 6 and 96 hours after feeding. Plasma was extracted from each blood sample and acidified to prevent degradation of acylated ghrelin. Using synthesized acylated chicken ghrelin (Phoenix Pharmaceuticals) it was determined that Millipore's total ghrelin RIA kit was not suitable for measuring total ghrelin levels in hen plasma, but their acylated ghrelin kit was validated. The concentration of plasma acylated ghrelin was significantly greater in the samples collected from the hens after 96 hours of fasting versus those collected at 6 hours. In 4 replicate experiments, granulosa cells were isolated from the F1, F3, and small yellow follicles from 3 hens. The cells for each follicle size were then cultured in M199 or M199 containing 50 ng/mL acylated ghrelin, 50 ng/mL LH, or 50 ng/mL of ghrelin and LH. The addition of ghrelin to the granulosa cell culture media did not alter P4 production or GHSR mRNA expression nor did it impact the stimulation of P4 production and the depression of GHSR mRNA expression by LH in cultured cells from the hierarchical follicles. The results indicate that fasting elevates plasma ghrelin levels in hens, but that elevated levels of ghrelin likely do not directly affect granulosa cell production of P4 or mRNA expression of GHSR.

Key Words: Ghrelin, RIA

M13 Method for isolating and culturing immature chicken oocytes. C. R. James*, W. D. Berry, S. S. Oates, and L. M. Stevenson, *Auburn University, Auburn, AL.*

Studies focusing on avian oocytes and their development are in need of advancement, and isolation and culturing techniques are important aspects of this advancement. This study is focused on dispersing and isolating the oocytes of immature chickens. The ovaries of immature chickens were removed and placed in ice-cold calcium/magnesium free Hanks balanced salt solution (HBSS). The ovaries were then washed several times in HBSS containing antibiotics/antimy-

cotics, and cut into very small pieces. An enzyme solution containing Type 2 collagenase, hyaluronidase, and pronase was introduced to the sample tissues. This mixture was placed in a shaking water bath at 37°C for 45 minutes. After this incubation period, the mixture was filtered through a 100-micron filter and centrifuged at 250x g for four minutes. The cell pellet was very gently resuspended by trituration in Media 199. This solution was again centrifuged at 250x g for eight minutes. This pellet was again gently resuspended by trituration in Media 199. The resulting avian cells were placed into culture flasks and incubated in CO₂ conditions for at least one hour. The immature avian oocytes were then examined. This work was supported by the Alabama Agricultural Experiment Station and the U.S. Poultry and Egg Association.

Key Words: Cell culture, Oocyte isolation, Avian oocyte, Cell dispersal, Immature oocyte

M14 Energy source levels in the liver of three-day-old broilers and their associations with percent incubational egg weight loss and time of hatch. R. W. Keirs*¹, E. D. Peebles¹, D. A. Braasch¹, and P. D. Gerard², ¹Mississippi State University, Mississippi State, ²Clemson University, Clemson, SC.

Liver lipid (LL) concentrations of 3-d-old broilers were found to be positively correlated to their time of hatch (TOH; $P \leq 0.03$). Conversely, liver glycogen (LGLY) concentration of 3-d-old chicks was negatively correlated with 0-18 d percent incubational egg weight loss (PEWL; $P \leq 0.05$). Furthermore, positive correlations were noted between concentrations of LGLY and liver glucose (LGLU; $P \leq 0.005$), and between concentrations of LGLY and liver protein (LPRO; $P \leq 0.0001$). Yolk lipid (YL) concentration was also negatively correlated with relative yolk weight ($P \leq 0.0001$). During incubation, PEWL was significantly higher for chicks that hatched at 480 h compared with those that hatched at 486 h. The LL of 3-d-old chicks was significantly higher when they hatched at 492 h than when they hatched at 480 h; whereas, LGLU increased numerically with TOH between 480 and 486 h, and again between 486 and 492 h. Because PEWL is a function of eggshell conductance and the incubational environment, the embryo must compensate for increases and decreases in PEWL through alterations in TOH and the utilization of available energy sources. Lipid reserves in the chick liver may be conserved when hatched from eggs with lower PEWL rates and with a longer TOH. The accumulation of LL with TOH may impact the utilization of alternate energy sources including LPRO, LGLU, and LGLY. Adjustments in PEWL can be made through changes in the incubational environment in accordance with eggshell conductance. Resulting PEWL may directly affect TOH and its modification may be necessary to optimize the utilization of available energy reserves, leading to improved broiler performance.

Key Words: Broiler, Incubational egg weight loss, Liver glycogen, Liver lipid, Time of hatch

Nutrition I

M15 Comparative analysis of nutritive value of three common species of aquatic plants as sources of protein in broiler production. B. O. Iyamu*¹, F. A. Iyoha², C. O. Imarhiagbe¹, and E. O. Uwagboe³, ¹Ministry of Agriculture and Natural Resources, Benin City, Edo State, Nigeria, ²College of Education, Benin City, Edo State, Nigeria, ³Cocoa Research Institute of Nigeria, Ibadan, Oyo State, Nigeria.

Three common species of aquatic plants in the tropics; water hyacinth *Eichornia crassipes*, water fern *Azolla africana* and Duck weed *Spirodela polyrrhiza* were freshly harvested, washed and killed by heating at a temperature of 105°C for 35 minutes. Temperature was reduced to 70°C, dried for 72hrs and pulverized. Analytical methods for crude protein, ash, ether extract, crude fibre and moisture content of the plants were determined using AOAC (1990). The proximate chemical analysis result revealed that the crude protein content of the plant ranges from 22.8 to 28.9 % for the three aquatic plants. There is no significant difference in crude protein for water fern and duck weed (27.8±0.6% and 26.8±0.2% respectively, $P \leq 0.05$) while significant difference exists for water hyacinth (21.8±0.6%, $P \geq 0.05$). The mineral constituents of the plants varied among species with duck weed having the highest values for Na, Ca, and Fe.

Duck weed had highest EAA values except for methionine which was highest in water fern (0.73%). At 20% inclusion level of the aquatic plants replacement of fish meal it was revealed that weight gain of broilers fed with water fern and duck weed were not significantly different ($P \leq 0.05$) and should be encourage for adoption by poultry farmers. In conclusion, the value of EAA in dehydrated aquatic plants such as water fern and duck weeds is quite comparable to most forage leguminous crops used for poultry diets.

Key Words: Comparative, Nutritive, Aquatic, Plants, Broilers.

M16 The hypocholesterolemic mechanisms of dietary *Rhodobacter capsulatus* in laying hens. A. G. Miah*, U. Salma, and H. Tsujii, *Shinshu University, Nagano, Japan.*

The present study was designed to investigate the hypocholesterolemic mechanisms of dietary *Rhodobacter capsulatus* by determining the hepatic cholesterol and bile acid, fecal cholesterol and bile acids, and studying the incorporation