

## Strategies for Improving Immune Responses against Disease

### 11 Nutritional modulation of immune function in broilers. M. T. Kidd\*, *Mississippi State University, Mississippi State, MS.*

Over half of the live performance cost in commercial chicken production is derived from diet and milling. Keeping this in mind it is not surprising that nutritional research makes up a large percentage of papers at some scientific forums and in journals. Most nutritional reports in broilers investigate its impact on growth and carcass traits, and rightly so because these traits are directly linked to profitability of poultry operations. However, research evaluating the impact of nutrition on immune responsiveness and the mechanisms behind this response is becoming commonplace in some laboratories. This research is of importance because it yields nutritional regimes that promote improved disease resistance in commercial broilers while maintaining good growth. Continued research in the area of nutrition and immune function interactions in broilers will lead to feeding strategies that can be implemented by the nutritionist. Specific nutrients impact immune cell metabolism and function. However, dietary modifications of these nutrients should not only consider the nutrient-immune function interaction, but the disease status and environment of the bird. Research reports addressing nutritional modulation of immunity in broilers and the commercial applicability of these reports will be discussed.

**Key Words:** Broiler, Immunity, Nutrition

### 12 Selection for avian immune function: A commercial breeding company challenge. J. E. Fulton\*, *Hy-Line International, Dallas Center, IA.*

Selection for immune function in the commercial breeding environment is a challenging proposition for commercial breeding companies. There are several factors that must be carefully considered in any breeding program. Immune response is only one of many traits that are under intensive selection, thus selection pressure needs to be carefully balanced across multiple traits. The selection environment (single bird cages, biosecure facilities, controlled environment) is a very different environment than the commercial production facilities (multiple bird cages, potential disease exposure, variable environment) in which birds are to produce. The testing of individual birds is difficult, time-consuming and expensive. It is essential that the results of any tests be relevant to actual disease/environmental challenge in the commercial environment. The use of genetic markers as indicators of immune function is being explored by breeding companies. Utilizing genetic markers would eliminate many of the limitations currently encountered by commercial breeding companies in enhancing immune function. Information on genetic markers could allow selection to proceed without subjecting breeding stock to disease conditions, and could be done before production traits are measured. These markers could either be candidate genes with known interaction/involvement with disease pathology, or DNA markers that are closely linked to genetic regions that influence the immune response. The current major limitation to this approach is the paucity of mapped chicken immune response genes and the limited number of DNA markers mapped on the chicken genome. These limitations should be removed once the chicken genome is sequenced.

**Key Words:** Selection, Immune response, Genetic markers, DNA analysis

## Environment and Management - Breeders and Incubation

### 13 The impact of varying nutrient allocation from photostimulation on carcass and reproductive traits of conventional and high-yield broiler breeder females. R. A. Renema\* and F. E. Robinson, *University of Alberta, Edmonton, AB., Canada.*

This study assessed the reproductive impact of genetic selection for growth and breast muscle yield on the sensitivity to overfeeding in female broiler breeders. Birds of three strains: Random-bred Strain 20 (RB20, unselected since 1977), Ross 308, and Ross 508 were assigned to one of three feeding levels from photostimulation (100%, 120%, and 140% of the amount needed to maintain the standard Ross 508 growth curve [Aviagen]). Pullets were reared on a common growth curve in light-tight conditions, 78 birds per strain were randomly assigned to a feeding treatment and individually caged at 20 wk, and photostimulated at 22 wk. A group of 90 birds were dissected at sexual maturity (SM) (first oviposition) to assess carcass and reproductive traits. An additional 144 birds were kept until 58 wk to monitor egg production, fertility and hatchability. Timing of SM was affected by strain, with the RB20, Ross 508 and Ross 308 birds laying eggs 16.5, 20.2, and 27.4 d after photostimulation, on average. The 120 and 140% treatments added 5.3% and 9.7% to BW at SM, respectively. The Ross 508 birds had the highest amount of breast muscle at SM (17.9%). RB20 hens were the fattest, reflecting the less efficient growth of their older genetics. Strain did not affect the number of ovarian large yellow follicles (LYF) (>10 mm diameter), although the Ross 308 ovary (59 g) was bigger than that of Ross 508 (51 g) or RB20 (46 g) birds. Egg production was most affected by feed, with 166, 159, and 137 settable eggs produced by the 100, 120, and 140% groups, respectively. Ross 508 birds were most sensitive to overfeeding, producing 177 eggs with the 100% feed compared to 123 eggs on the 140% feed, while unsettable eggs increased from 1.7 to 6.7%. Only 2.3% of RB20 eggs were unsettable compared to 5.1 and 4.0% of Ross 308 and 508 eggs, on average. The detrimental effects of overfeeding are more pronounced in modern, high breast yield strains.

**Key Words:** Broiler breeder, Sexual maturity, Feed allocation, Egg production, Genetic strain

### 14 Effect of nutrient density and time of photostimulation on reproduction in fast- and slow-feathering turkey hens. V. R. Sikur\*<sup>1</sup>, F. E. Robinson<sup>1</sup>, D. R. Korver<sup>1</sup>, R. A. Renema<sup>1</sup>, and M. J. Zuidhof<sup>2</sup>, <sup>1</sup>*University of Alberta, Alberta Agriculture, Food and Rural Development.*

Chickens have been sexed on the basis of feather growth for many years, but the slow feathering gene has only recently been incorporated into a line of turkeys. This study was conducted to compare fast and slow feathering turkey females in regard to body weight (BW) gain, carcass composition and reproductive fitness. A total of 864 fast-feathering (FF) and slow-feathering (SF) poults were fed either a control (CON) or a high-energy, high-protein (HIGH) diet. Birds were photostimulated at 29 or 31 wk. Data on body weight (BW) and carcass characteristics (girth, shank, keel, breast width, breast muscle, fatpad, liver, ovary and oviduct) and egg production were assessed over the course of the trial. At photostimulation (PSTIM), FF birds had increased shank length (2.6%) and breast width (5.6%) when compared to SF birds. After photostimulation, FF birds were heavier than SF birds, to a maximum of 7.8%. FF hens had greater stroma weight (25%), ovary weight (49%), oviduct weight (52%), keel length (2.8%), number of LYF by one follicle at the end of lay, and BW in both strains during peak egg production. Number of LYF was higher in delay photostimulated birds (8.3) compared to birds photostimulated 2 wk earlier (7.8). Absolute ovary weight and oviduct weight increased by 21% and 18% respectively in 31 wk birds compared to 29 wk birds. These effects of delayed photostimulation were magnified in SF birds. FF hens had significantly higher % egg production (55 vs. 33%), peak production (76 vs. 68%), sequence length (5.7 vs. 3.3 d) and persistency, as well as increased pause length (1.5 vs. 1.8 d) compared to SF hens. Delaying photostimulation did not affect total egg production but reduced the number of double-yolked eggs. These data suggest that FF birds are heavier and have increased egg production when compared to SF birds, but delaying photostimulation has a positive effect on reproductive fitness.

**Key Words:** Turkeys, Feather sexing, Reproductive efficiency, Carcass composition

**15 Effect of broiler breeder age and dietary zinc source on chick characteristics and incubation requirements.** B. P. Hudson\*, B. D. Fairchild, W. A. Dozier, III, and J. L. Wilson, *The University of Georgia, Athens, GA.*

Chick quality can impact the incidence of morbidity and mortality of broilers during the first weeks of production. Chick quality assessments have primarily been made by subjective observations. Both hen age and zinc source in hen diets have been shown to affect livability of progeny. This experiment evaluated the effects of broiler breeder age and dietary zinc source on incubation time and physiological characteristics of chicks at hatching. Cobb 500 hens were given one of three diets from 0 to 65 wk. All experimental diets consisted of 160 ppm supplemental Zn from ZnSO<sub>4</sub>, Availa® Zn zinc amino acid complex (ZnAA), or a mixture of ZnSO<sub>4</sub> and ZnAA (ZnSO<sub>4</sub>+ZnAA, 80 ppm Zn from each). Eggs collected from hens at 29, 41, 53 and 65 wk of age were incubated. Dry chicks were counted and removed on 4 hr intervals from 468 through 528 hr of incubation. Carbohydrate metabolism and organ development were evaluated on chicks removed at 492 hr of incubation. Distribution of incubation time was not influenced by hen age, but mean incubation time decreased 4.9 hr (P<0.05) from 29 to 53 wk of age and increased 2.4 hr (P<0.05) from 53 to 65 wk. Chick weight increased (P<0.05) 6.5 g as hens aged from 29 to 41 wk, and 4.2 g from 41 to 65 wk of age. Egg weight increased (P<0.05) 17.2 g from 26 to 46 wk and 2.2 g from 46 to 66 wk. Relative yolk sac weight of progeny was depressed (P<0.05) when breeders were 29 wk of age. Plasma glucose of chicks was lowest (P<0.05) when parents were 53 wk of age, and heart glycogen in chicks declined as hens aged. Weight and length of jejunum were highest (P<0.05) in progeny from 53 wk old breeders, as were heart and liver weights. Hen age had no effect on pipping muscle weight, hepatic glycogen or hepatic zinc concentration in progeny. When hens were 53 wk of age, chick jejunum length was greater (P<0.05) when hens consumed ZnSO<sub>4</sub> (30.4 mm) rather than ZnAA (27.0 mm) or ZnSO<sub>4</sub>+ZnAA (26.2 mm). These data indicate that zinc source in breeder hen diets had limited effects on incubation requirements or chick characteristics, but hen age affected carbohydrate metabolism and organ development in progeny.

**Key Words:** Broiler breeder age, Dietary zinc, Broiler chick, Incubation time, Carbohydrate metabolism

**16 Increased hatcher temperature adversely affects chick quality and survival during production whereas final body weights and processing yields are unaffected.** N. S. Joseph\* and E. T. Moran, Jr., *Auburn University, Auburn, AL.*

Eggs from a 31 week old Ross x Ross 308 breeder flock (n=1800, 56 g average wt.) were incubated under standard terms for the first 18 days. Viable embryos (94.7%) were then divided and subjected to either control (37.3°C) or high (38.5°C) temperatures in separate hatchers for the next 3 days. Total chick yield was similar between control and high temperature treatments (grand mean=88.8%) as was the proportion of weak chicks (grand mean=1.1%). However, high temperature increased late-dead germs (2.4 for high vs 1.1% for control temperature treatments, respectively; P=0.053) and reduced body weight of viable chicks (38.7 vs 40.0 g; P=0.046) without affecting yolk sac reserves (grand mean=5.1 g). Saleable chicks were placed in floor pens, sex-separate, and reared to 42 days of age, then, all were processed. The difference in chick weight between treatments progressively declined through 17 days of age before disappearing by 32 days. However, increased mortality of heat-stressed birds was apparent by 17 days of age (10.8 vs 3.7%; P=0.055), which gradually continued through 42 days of age (13.3 vs 5.4%; P=0.048). Differences in depot fat removed from the abdominal cavity, chilled carcass weight, incidence of defects associated with carcass grade, and the amount of skinless boneless breast meats with cone deboning were not evident. High hatcher temperature adversely affected chick weight at placement and subsequent survival, but those attaining market age recovered, and had carcass yields comparable to those in the control treatment.

**Key Words:** Broiler, Hatcher temperature, Post-hatch growth, Mortality, Carcass yield

**17 Effect of egg storage time and temperature on embryo development in broiler breeders.** R. K. Bramwell\*, K. R. Shaffer, and D. J. Donoghue, *Center of Excellence for Poultry Science, University of Arkansas, Fayetteville, Arkansas.*

While storage of hatching eggs has been investigated, standard industry practices have largely remained unchanged. Egg storage is a necessary process in the industry to accumulate the proper number of eggs necessary for each setting. The goal, then, of egg storage is to bring to a standstill embryo development while maintaining their ability to resume development and produce viable and healthy chicks. Therefore, the purpose of this study was to evaluate several egg storage temperatures to determine the effect on the subsequent embryo growth and development of hatching eggs after storage. In the first trial, fresh broiler breeder hatching eggs were obtained from a local integrator and stored at 21.1, 23.9, 26.7, 29.4 or 32.2 C for 24, 48, 72, or 96 hr. Each group consisted of between 15 and 30 eggs with each storage time and temperature replicated five times. Following storage, each egg in each group was broken open and the germinal disc (GD) diameter measured to evaluate the presence or lack of embryo development. The average diameter of the GD in fresh un-stored eggs (0 hr storage) was 4.87 mm. For eggs stored at 21.1 and 23.9 C, the average diameter of the GD was not different between storage times with the mean GD measurements of 4.88 and 4.87 mm, respectively. When eggs were stored at 26.7 C the mean GD measurements were 5.44, 6.08, 6.54 and 9.13 mm for the 24, 48, 72 and 96 hr time intervals. Eggs stored at 29.4 C had mean GD measurements of 6.01, 10.19, 16.68 and 22.62 mm for the four time intervals respectively. When eggs were stored at 32.2 C the mean GD measurements were 7.41, 15.48, 28.23 and 38.96 mm for the four storage time groups. The average GD measurements for all storage time intervals for each temperature group were 4.88, 4.87, 6.80, 13.88 and 22.52 mm for the 21.1, 23.9, 26.7, 29.4 and 32.2 C groups, respectively. These data indicate embryo development can be stopped when eggs are stored at 23.9 C and below.

**Key Words:** Hatching egg storage, Embryo development

**18 Effect of embryonic temperature during incubation on organ development in broilers.** N. Leksrisompong\*, J. S. Swanner, and J. Brake, *North Carolina State University, Raleigh, NC USA.*

Incubation is one of the most important stages of development for the growing broiler and the effect of embryo temperature on this development was studied in two experiments. There were two groups of broiler hatching eggs in each experiment in this study, which were considered to be normal temperature (between 99.5 and 101 F) and high temperature (between 101 and 105 F). These temperatures are in the range that can be found under commercial conditions. Relative humidity was maintained at 53% at all times. Egg temperatures were monitored throughout incubation and all eggs were measured at 20 days with a calibrated Braun Thermoscan infrared thermometer. Egg temperature was 100.5 and 103.4 for the normal and high groups in Experiment 1 and 101.2 and 104.6 for the normal and high groups in Experiment 2, respectively. At hatching chicks were weighed, euthanized, and the yolk sac, liver, heart, proventriculus, gizzard, and remaining gastrointestinal (GI) tract were excised and weighed. In Experiment 1 BW and relative weights of the yolk sac, heart, and proventriculus were decreased in the high temperature group. In Experiment 2 BW and relative weights of the heart, proventriculus, gizzard, and GI tract were reduced in the high temperature group while the relative weight of the yolk sac was increased. High embryo temperatures during incubation appear to negatively affect embryo development and this may cause metabolic problems in broilers. Better control of embryo temperature during incubation may reduce problems in the transition from hatching through the first week of brooding.

**Key Words:** Incubation temperature, Broiler hatching eggs, Embryo development, Embryo temperature

**19 Effects of egg weight and location in incubator relative to fan on hatchability of broiler hatching eggs.** O. Elibol<sup>1</sup> and J. Brake\*<sup>2</sup>, <sup>1</sup>University of Ankara, Ankara, Turkey, <sup>2</sup>North Carolina State University, Raleigh, NC USA.

Hatching eggs from Ross 344 male x Ross 308 female broiler breeder flocks at 51 wk or 58 wk of age were stored for 2 d at 18C and 75% RH in Experiments 1 and 2, respectively. Eggs were graded into three egg weight groups termed small (~62.4 g), medium (~65.4 g), and large

(~68.9 g). Each egg weight group was set in the dolly most distant from the fan (FAR) or set in the dolly nearest the fan (NEAR) as would be the case for single-stage operation in a Petersime Model 576 setter and Model 192 hatcher. Fertile hatchability decreased in the large egg weight group due to increased percentage late dead embryonic mortality in Experiment 1, and both early and late embryonic mortality in Experiment 2. Late embryonic mortality increased and fertile hatchability decreased for eggs in the FAR treatment in Experiment 1 only. A significant interaction of incubator position by egg weight group for late embryonic mortality and fertile hatchability was found in Experiment 1 and but only late embryonic mortality was so affected in Experiment 2. It is suggested that air velocity is diminished in the FAR position of the incubators and large eggs are influenced negatively in this position. Egg temperatures taken at 18 days of incubation in Experiment 2 revealed an elevated temperature (>1 F) for the large eggs in the FAR position, which is the probable cause of the late embryonic mortality.

**Key Words:** Egg weight, Air flow, Hatchability, Embryonic mortality, Broiler hatching eggs

**20 Effects of embryonic temperature on hatchability and post-hatch performance of a high meat-yielding broiler strain.** R. M. Hulet<sup>\*1</sup>, E. Wheeler<sup>1</sup>, W. B. Roush<sup>1</sup>, M. Wineland<sup>2</sup>, V. Christiansen<sup>2</sup>, and A. McElroy<sup>3</sup>, <sup>1</sup>Pennsylvania State University, <sup>2</sup>North Carolina State University, <sup>3</sup>Virginia Polytechnic Institute and State University.

High incubation temperature has been recently shown to affect some strains of high-yielding broilers. A study was conducted to measure embryonic heat production (during incubation), hatchability, and post-hatch performance of a strain of high meat-yielding broiler breeder (93% fertility). Twelve hundred fifty-eight eggs were incubated at an egg shell-temperature of 101° F for fourteen days. Then half of the eggs were transferred to a hatcher at an egg-shell temperature of 103° F (High), while the remainder of the eggs was incubated at an egg-shell temperature of 101° F (Control) for the remaining one week. Hatch of transferred Eggs for the Control eggs (90.12%) was six percent greater in hatch than the High temperature treatment (83.79%). Late dead embryos (4% increase) and pipped embryos (2% increase) were significantly greater for the High temperature treated eggs when compared to the Control eggs. Post-hatch broiler growth was found to be significantly higher ( $P \leq 0.05$ ) for Control broilers at hatch, 21, and 35 days of age when compared to the body weight of the High temperature birds. First week (High, 3.01%; Control, 1.39%) and cumulative mortality (High, 5.56%; Control, 3.71%) were not significantly different between treatments, but observations of ascites-caused late mortality for the High incubation heat-treated broilers were found. Controlling shell-temperature during incubation of high-yielding broilers is important for improving hatchability and post-hatch growth performance.

**Key Words:** Incubation, Hatchability, Egg-Shell Temperature, Post-Hatch Growth

**21 Transfer of antibiotics into the yolk sac of neonatal chicks: Potential adverse effect on competitive exclusion culture establishment.** D. J. Donoghue<sup>\*</sup>, P. J. Blore, and R. K. Bramwell, Department of Poultry Science, University of Arkansas, Fayetteville, AR 72701.

The administration of non-pathogenic microflora to neonatal poultry can be an effective strategy to reduce enteric colonization of food borne pathogens, especially Salmonella. These non-pathogenic microflora, also called competitive exclusion cultures (CE), are most effective when administered to neonatal chicks. It is known that therapeutic use of antibiotics in chicks may destroy the CE microflora and enhance enteric pathogen colonization. Less clearly understood is the potential for accumulation of therapeutic concentrations of antibiotics in the developing chick following administration of antibiotics to breeder hens. Recently, McReynolds and coworkers (2000) reported reduced CE efficacy against Salmonella colonization when the antibiotic, enrofloxacin used to treat hens, was detected in the yolk sac of neonatal chicks. These researchers did not determine the concentration or persistence of enrofloxacin in neonatal chicks. Therefore, eighty hens housed with roosters were dosed with the FDA approved dose of 50 ppm/enrofloxacin in the water for 3 or 7 days (n=40/treatment). Fertile eggs were collected for 10 days post antibiotic treatment, set and hatched. Following hatch, chicks were

sacrificed daily up to 4 days post-hatch and the yolk sac contents collected for analysis. Yolk sac samples were assayed for enrofloxacin using a quantitative agar diffusion bioassay (Donoghue and Schneider, 2003). Results indicate that enrofloxacin was detected in the yolk sac of chicks produced from hens treated within the first day of dosing. The longer the hens were dosed, the higher the enrofloxacin concentrations (from 463 to 1112 ng/g) were in the yolk sac of the offspring. Furthermore, enrofloxacin was detected in the yolk sac for up to 4 days after hatch. These results support the idea that antimicrobials can accumulate and possibly interfere with CE establishment in chicks produced from antibiotic treated breeder hens.

**Key Words:** Enrofloxacin, Yolk sac, Residues, Competitive exclusion

**22 Efficacy of boiling water immersion for collection of separate external and internal microbiological samples of breeder testes for *Salmonella* and *Campylobacter* spp.** R. J. Buhr<sup>1</sup>, J. S. Bailey<sup>1</sup>, D. E. Cosby<sup>\*1</sup>, N. A. Cox<sup>1</sup>, D. V. Bourassa<sup>2</sup>, L. J. Richardson<sup>1</sup>, and M. T. Musgrove<sup>1</sup>, <sup>1</sup>US Dept of Agriculture, ARS, Russell Research Center, Athens, Georgia, <sup>2</sup>Dept of Poultry Science, University of Georgia, Athens, Georgia.

To determine if hot water immersion would kill bacteria on the external surface of the testes, we aseptically collected 60 testes from broiler-breeder roosters that were partially processed, prior to evisceration. Testes were placed into Stomacher<sup>TM</sup> 400 bags and transported to the laboratory on ice where the testes were placed into one of nine groups (five testes per group). One group served as the negative control and was not inoculated or immersed in hot water. Four groups were inoculated with a cocktail of Nalidixic Acid resistant *Salmonella* (*Sal* NR), two internally and two externally. The remaining four groups were inoculated with *Campylobacter* (*Campy*), two internally and two externally. Testes of the control group underwent standard FSIS testing for *Sal* NR and *Campy*. For half of the *Sal* and *Campy* inoculated groups, individual testes were placed into 100 ml sterile plastic disposable specimen cups. Enough boiling water was added to the testes in order to cover the testes and allowed to remain for 30 s. The water was decanted, the testes placed into bags and placed into an ice bath. The remaining groups were not subjected to boiling water and served as positive external and internal inoculated controls. The testis was smashed with a mallet, BPW added, and the suspension serially diluted onto BGS agar plates with nalidixic acid (*Sal* NR) or Campy-CEFEX (*Campy*) plates. No positives colonies were detected in the negative control group testes. Recovery levels did not differ significantly between the internal inoculated-boiled testes, internal inoculated-not boiled testes, and the external inoculated-not boiled testes. There was a four log reduction in numbers of *Sal* NR for the external inoculated-boiled testes compared to the external inoculated-not boiled testes, and a corresponding three log reduction for *Campy*. With the low numbers of bacteria typically recovered from the external surface of a healthy rooster's testes, this boiling method provides a way to sample the internal tissue of the testes and eliminate potential for air sac contamination of the sample.

**Key Words:** Breeders, Testes, Microbiological sampling

**23 Effects of aeration and storage temperature on *Campylobacter* concentrations in chicken semen.** K. Cole<sup>\*1</sup>, P. J. Blore<sup>1</sup>, J. S. Holiman<sup>1</sup>, A. M. Donoghue<sup>2</sup>, M. T. Musgrove<sup>3</sup>, N. A. Cox<sup>4</sup>, and D. J. Donoghue<sup>1</sup>, <sup>1</sup>Department of Poultry Science, University of Arkansas, Fayetteville, AR 72701, <sup>2</sup>USDA/ARS PPSRU, Fayetteville, AR 72701, <sup>3</sup>USDA/ARS PPMQRU, Russell Research Center, Athens, GA 30605, <sup>4</sup>USDA/ARS PMSRU, Russell Research Center, Athens, GA 30605.

Recent research has shown that *Campylobacter* is present in chicken and turkey semen and may contribute to the vertical transmission between the breeder hen and offspring. As *Campylobacter* is considered sensitive to oxygen and cold temperature, this study was undertaken to determine if aeration and varying temperature could reduce the amount of *Campylobacter* in chicken semen. In 4 separate trials, commercial roosters were individually caged and semen samples were collected by abdominal massage and pooled. The pooled semen samples were inoculated with 106 to 107 cfu of *C. jejuni*. Semen was then divided into three aliquots and subjected to: 1) no aeration, or bubbling for 20 min with 2) oxygen, or 3) ambient air. After aeration samples were further aliquoted to test storage at three temperatures (4C, 23C or 42C) for 24 h. During storage, semen was sampled at 0, 2, 6 and 24 h and then plated onto Campy-Line

agar for 48 h for *Campylobacter* enumeration. Aeration of the semen by either method did not reduce the amount of *C. jejuni* in semen compared to controls at all temperatures. Similarly, *C. jejuni* growth after storage of semen at 4 or 24C was not different for any of the sample times. *C. jejuni* was significantly reduced, however, when stored for 24h at 42C (4 log reduction). Aeration and reduced temperatures, typical procedures used to maintain sperm viability before insemination did not reduce *Campylobacter* concentrations in vitro. Studies are currently underway to determine if these treatments have similar effects on turkey semen, however it appears that alternative methods will be needed to reduce *Campylobacter* contamination of poultry semen. Funded in part by U.S. Poultry and Egg Association #394 and the USDA Food Safety Consortium.

**Key Words:** *Campylobacter*, Semen, Aeration

**24 Broiler Breeder roosters' ability to naturally mate after utilizing ultrasound as a non-destructive means to measure testicular size.** L. J. Richardson<sup>\*1</sup>, J. L. Wilson<sup>1</sup>, E. R. Bowling<sup>1</sup>, A. B. Caudle<sup>2</sup>, and K. C. Powell<sup>3</sup>, <sup>1</sup>*Poultry Science Department, University of Georgia*, <sup>2</sup>*Veterinary Medicine, University of Georgia*, <sup>3</sup>*Roche Animal Nutrition and Health*.

The use of an Ultrasound machine (Aloka SSD-900V) fitted with a linear surgical probe (UST-5526L-7.5 laproscopic transducer) has been shown to be a non-destructive means to internally measure testicular size in broiler breeder roosters without effecting semen ejaculation. However, the effect of the ultrasound procedure on the roosters ability to naturally mate needed to be investigated. The objective of this trial was too; evaluate the effect of the ultrasound procedure on the natural mating frequency of the broiler breeder male and subsequent fertility of the flock. Thirty-seven week old broiler breeders were housed in 16 pens (60 females and 6 males/pen) that were designed to industry standards [2/3rd slats, 1/3rd scratch; nipple drinkers; mechanical trough (females), and pan feeder system (males)]. Eight of the pens were randomly designated as the control, while the remaining pens were randomly designated as the treatment. At 37 weeks of age, 4 mating observations were taken over six days prior to the ultrasound procedure and eggs incubated and eggs were candled to estimate fertility at 14 days of incubation. At 38 weeks of age, the roosters in the treatment pens were ultrasounded. Following ultrasound, three mating observations were taken over a three-day period. Seven days following ultrasound, one final mating observation was performed. Eggs were collected and incubated weekly over a four-week period following the ultrasound procedure. There were no significant differences in mating frequency between the control pens when compared to the treatment pens. The mean fertility in the control pens was 97.79 percent and not found to be significantly different ( $P=0.05$ ) compared to the treatment pens fertility of 97.87 percent. The natural mating ability of the broiler breeder rooster was not affected after an ultrasound procedure to measure testicular size in broiler breeder rooster. These observations support the use of ultrasound measurements as a non-destructive means of assessing testis size in breeder males.

**Key Words:** Broiler breeder, Ultrasound, Fertility, Testis

**25 The optimum semen dilution for the Sperm Quality Index that is most predictive of fertility when inseminating with a constant volume of semen.** H. M. Parker<sup>\*</sup> and C. D. McDaniel, *Mississippi State University*.

The Sperm Quality Index (SQI) predicts semen quality and fertility by measuring the deflections created in a light path by sperm movement.

The objective of this study was to establish if a semen dilution rate below 10-fold could improve the ability of the SQI to predict semen quality and fertility when hens are inseminated with a constant volume of semen. Once a week for 3 wk, semen was collected from 28 Cobb males, and ejaculates were analyzed for sperm concentration, viability, and the SQI. After obtaining an SQI for neat semen, semen was diluted 2-, 4-, 8-, 10-, and 25-fold prior to analysis for the SQI, and 15 hens/male were inseminated with 20  $\mu$ L of 1:4 diluted semen. To determine which semen dilution rate yielded an SQI that was most predictive of fertility, Pearson's correlation coefficients were obtained for the SQI at each dilution rate with fertility and also with different sperm characteristics. Correlation coefficients for the SQI at each dilution rate with fertility and sperm viability were statistically similar. The coefficients for the correlation of the SQI with fertility were 0.75, 0.72, 0.72, 0.66, and 0.61, for the 4-, 8-, 10-, 25-, and 2-fold dilutions, respectively. The correlation coefficients for the SQI with sperm viability were 0.68, 0.65, 0.65, 0.63, and 0.49 for the 2-, 4-, 10-, 8-, and 25-fold SQI dilutions. The SQI from 25-, 10-, and 8-fold dilutions produced a statistically stronger correlation with total sperm concentration ( $r=0.85, 0.82, \text{ and } 0.80$ , respectively) when compared to the 4-fold SQI dilution ( $r=0.68$ ) correlation. Correlation coefficients for live sperm concentration were also statistically higher for 25-, 10-, 8-fold, and 4-fold SQI dilutions ( $r=0.86, 0.86, 0.83, \text{ and } 0.73$ , respectively) as compared to the 2-fold SQI dilution which had a non-significant relationship. It appears that the 10-fold SQI dilution is the most consistent at predicting fertility and semen quality.

**Key Words:** Sperm Quality Index, Fertility, Broiler breeder, Semen, Artificial insemination

**26 Effect of organic selenium (Selplex<sup>®</sup>) and male comb size on initial broiler breeder fertility.** H. Romero-Sanchez<sup>\*</sup>, P. Plumstead, B. A. Lenfestey, C. V. Williams, and J. Brake, *North Carolina State University, Raleigh, NC USA*.

An experiment was conducted to test the effect of organic selenium (Selplex<sup>®</sup>) on fertility of male broiler breeders subjected to the same cumulative nutrition to photostimulation (20 wk of age) but with evidence of different stage of sexual maturity as indicated by comb size. From a group of 96 Ross 344 males, the males with the largest and smallest comb size were divided into two groups that were then randomized into 16 pens (6 males per pen) with 55 Ross 308 females. Pens received a diet with or without organic selenium in a 2 x 2 factorial design with respect to male treatment with 4 replicates per interaction cell. BW, comb size, and shank length of males were measured at 20, 22, 24, 25, 27, 29, and 32 wk. Analysis of percentage egg fertility was done weekly from 28 to 34 wk with arcsine transformation carried out before statistical analysis. Males were fed the same diet as that of the female and separation of sexes was insured by special grills on the feeders. The male feed allocations were intended to be restrictive. Differences in male BW and shank length were positively associated with comb size although the small comb size group exhibited a significantly higher comb growth rate. The large comb males did experience a plateau in BW gain at 24 wk of age while the small comb males continued to gain BW. Grouping by comb size did not affect fertility. However, there were significant differences in fertility due to organic selenium and interaction of comb size and organic selenium. Organic selenium improved fertility of large comb males by up to 4%, but did not affect small comb males. The significance of this effect decreased with age from  $P < 0.004$  to  $P < 0.1$  from 28 to 34 wk of age. These data suggest that when early maturing males (large comb) were slightly underfed after photostimulation organic selenium had a nutrient sparing effect that allowed them to maintain high fertility even when they did not gain BW in a consistent manner.

**Key Words:** Broiler Breeders, Fertility, Organic Selenium, Comb Size

## Immunology

**27 Determination of cytokine activity in crude and fractionated supernatants from the chicken Harderian gland.** N. H. Noblet, M. D. Owens, A. B. Bodine, and T. R. Scott, *Clemson University*.

The Harderian gland (HG) of chickens, as in many other avian species, is unique in that it is populated with a large number of plasma cells and serves as a peripheral lymphoid organ that is responsible for protecting the ocular region and the upper respiratory tract. Previous work in our

laboratory demonstrated that a soluble factor(s) present in the processed supernatant (SPNT) of the gland positively influences bursa of Fabricius-lymphocyte proliferation, as evaluated using a co-mitogenic bioassay with phorbol-12,13-dibutyrate used as the stimulating mitogen. The goals for this experimentation were to corroborate previous findings, identify (glyco)protein candidates with cytokine activity, and develop an antibody source capable of inhibiting the proliferative influence of the HG-SPNT, as evaluated by the bursal cell co-mitogenic bioassay. SDS-PAGE was performed to visualize the low molecular weight proteins (10-30 kDa)