Two consecutive experiments were conducted to evaluate the influence of dietary composition, specifically protein and amino acid profile, on oocyst output and intestinal lesion development in male and female replacement broiler breeders of two different genetic lines. The first experiment was conducted on fresh pine shavings as the litter source while the second trial was conducted on the used litter following the first experiment. Dietary formulation was based on either breeder specific recommendations or formulations of a broiler integrator. Fecal material was collected on an every other day basis from 6 to 41 days of age to determine oocyst output. Lesion assessment was performed throughout the experiments to evaluate gross and microscopic intestinal lesions. In experiment 1, both genetic lines were associated with multiple peaks in oocyst output, with the first peak occurring at approximately 16 to 18 days post placement. This first peak tended to have the highest observed magnitude and corresponded with the highest level of intestinal lesions observed during the trial. Oocyst cycling in experiment 2 did not follow similar patterns. Peaks were delayed and at a lower magnitude. Dietary interactions were observed in both experiments where magnitude or duration of oocyst output and severity of lesion development was influenced by diet in both male and female genetic lines. These data indicate the dietary composition impacts oocyst cycling and lesion development during coccidiosis vaccination in replacement broiler breeders.

**Key Words:** broiler breeder, protein, oocyst, lesion, vaccination

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**P145** Velocigenic Newcastle disease viruses from Mexico belonging to two lineages of genotype V have difference in virulence. R. Merino* and N. L. Calderon, Departamento de Producción Animal: Aves, Facultad de Medicina Veterinaria y Zootecnia, Universidad Nacional Autónoma de Mexico, Mexico, DF, Mexico.

Velocigenic Newcastle disease virus has threatened the Mexican poultry industry since 1946. Nine strains of velocigenic Newcastle disease virus were isolated in central and northern Mexico from 1998 to 2006 and subjected to phylogenetic analysis and biological characterization using standard pathogenicity tests. Phylogenetic analysis showed that all newly characterized velocigenic strains belonged to genetic group V and are clearly divided in two lineages, since phylogenetic similarities between groups are of only 93-94%; isolates from 1998 to 2001 are closely related to the strain responsible for the 2000 year outbreak raised in La Laguna region (Torreon strain), and are phylogenetically distinct from viruses isolated between 2004 and 2006 that are genetically related to the Chimalhuacan strain isolated in 1973. All the viruses of both, the Chimalhuacan and the Torreon groups, contained a virulent fusion protein cleavage site represented by the motif “GGRRQKRF”, revealing that evolutionary changes occurred at a different site. Fifty percent lethal dose in chicken embryo ranged from $10^{5.1}$ to $10^{6.5}$ LD$_{50}$/ml and does not seem to be related to the virus phylogenetic lineage. Chicken embryo mean death time values were shorter for the viruses isolated after 2001 (45.2 hours), when compared with the 1998-2001 average (51.8 hours). ICPI average value was higher (1.92) for viruses isolated during 2004-2006 than that for viruses isolated before 2001 (1.75). Along with the ICPI and MDT results, our findings suggest that some distinct selective pressure on the Chimalhuacan strain isolated in early 1970’s may have led to the appearance of the new group (Torreon-like) in the middle of 1990’s. The vaccination pressure raised after the 2000 outbreak may account for the reduction of Torreon-like isolates, then allowing the re-emerge of the more virulent Chimalhuacan-like isolates in the following years, once the vaccination programs went back to those used in central region of Mexico before the 2000 outbreak. Studies on tropism to lymphoid organs of broiler chickens are in progress, results will be also discussed.

**Key Words:** Newcastle disease virus, Mexico, genotype V, lineages, virulence
according to our data, these chicks had better yellow skin pigmentation and a lower amount of oocysts in feces, however these levels are not optimal in birds treated with an anticoccidial program, this could be associated with a loss of effectiveness of the drugs because the permanent addition during several years on the diet.

Key Words: nicarbazine, monensine, anticoccidial program, skin pigmentation, broilers

P147 Influence of experimental LPAI virus infection on susceptibility of wood ducks to H5N1 HPAI virus. T. P. Costa*SC1, D. E. Stallknecht1, J. D. Brown1, E. W. Howerton1, and D. E. Swayne2, 1University of Georgia, Athens, 2USDA-ARS-Southeast Poultry Research Laboratory, Athens, GA.

In order to evaluate if a pre-exposure to a low pathogenic avian influenza (LPAI) virus provides protective immunity to wood ducks (Aix sponsa) challenged with a H5N1 highly pathogenic avian influenza (HPAI) virus, twenty-five 1-year old wood ducks, evenly divided into 5 groups, were intraocularly inoculated with 106 EID50 of the following LPAI viruses: A/mallard/Netherlands/2/05 (H5N2), A/blue-winged teal/LA/B228/86 (H1N1), A/mute swan/MI/451072-2/06 (H5N1), and A/mallard/MN/355770/00 (H5N2). The fifth group was not exposed to a LPAI virus. After 21 days, the birds were challenged with 106 EID50 of the HPAI virus A/whooper swan/Mongolia/244/05 (H5N1). All four groups infected with a LPAI virus had reduced morbidity and mortality compared to the naïve group, suggesting pre-exposure to a LPAI virus provided some level of protective immunity. The level of protection, however, varied between LPAI isolates:
No LPAI exposure - 100% morbidity, 100% mortality; Netherlands/05 (H5N2) - 80% morbidity, 80% mortality; LA/86 (H1N1) - 60% morbidity, 60% mortality; MI/06 (H5N1) - 20% morbidity, 20% mortality; MN/00 (H5N2) - 0% morbidity, 0% mortality. The cause and mechanism for this protection and variation among isolates will be discussed herein. These results suggest that LPAI viruses naturally circulating in waterfowl populations can influence the susceptibility of these wild avian populations to H5N1 HPAI virus.

Key Words: avian influenza, LPAI, HPAI, susceptibility, wood duck

P148 Evaluation of management practices and Salmonella prevalence on broiler breeder farms in the Southeastern United States. D. L. Mathis*, M. D. Lee1, J. J. Maurer1, J. L. Wilson1, R. K. Bramwell2, K. S. Macklin1, M. J. Wineland2, and R. D. Berghaus1, 1University of Georgia, Athens, 2University of Arkansas, Fayetteville, 3Auburn University, Auburn, AL, 4North Carolina State University, Raleigh.

Salmonella is a leading cause of foodborne illness in the United States and poultry has been recognized as a common vehicle in past outbreaks. In this study, Extension agents are visiting 15 broiler breeder farms in each of four states (Alabama, Arkansas, Georgia, and North Carolina) to perform environmental sampling for the detection of Salmonella and to evaluate management practices thought to be important in Salmonella transmission. Farm-level, flock-level, and individual sample-level Salmonella prevalences for the first 43 farms enrolled were 91%, 86%, and 42% respectively. Within individual houses, the prevalence of Salmonella-positive samples ranged from 0-92%. Only 38% of the farms used disinfectant footbaths at house entryways and only 31% kept a record of visitors to the farm. Most producers (82%) indicated that they had an active rodent control program although the control was considered to be inadequate on 33% of farms. In the Southeastern U.S., most broiler-breeder flocks are infected with Salmonella (90%), Biosecurity and rodent control are common management deficiencies.

Key Words: Salmonella, management practices, broiler breeder, prevalence, biosecurity

P149 Probiotic administration during coccidiosis vaccination in broilers: Evaluation of protection against clinical Eimeria challenge. A. E. Klein*SC1, J. Lee1, M. Farnell1, L. Oden1, S. Pohl1, M. Mohn2, R. Beltran2, G. Schatzmayr2, C. Broussard3, S. Fitz-Coy3, and D. Caldwell1, 1Texas A&M University, College Station, 2Biomin GmbH, Herzogenburg, Austria, 3Intervet-Schering Plough Animal Health, Millsboro, DE.

Recent reports from our laboratories have shown that probiotic administration during coccidiosis vaccination can increase immune responses and improve intestinal health during subclinical challenge by field strain Eimeria. The objective of this trial was evaluate live oocyst vaccination, with our without drinking water probiotic administration, for protection against clinical field strain Eimeria challenge. Experimental groups consisted of control, probiotic (Biomin® PoultryStar), vaccine (Coccivac-B®) and vaccine + probiotic, placed in four pens of 40 broilers each. All broilers were weighed then orally challenged with field strain Eimeria on day 35. All broilers were weighed and subjected to necropsy on day 42 for gross and microscopic intestinal lesions, as well as upper and lower intestinal weights. Body weight gain among vaccinated broilers was significantly increased (P<0.05) during the seven day challenge period. Both probiotic and vaccine significantly decreased (P<.05) gross lesion scores in upper and mid-intestinal regions. A significant reduction (P<.05) in gross lower intestinal lesion score was also observed in the vaccine alone group. These findings were supported by microscopic lesion scores in vaccinated broilers where significantly reduced (P<.05) upper and mid-intestinal lesions were observed. Broilers receiving both vaccine and probiotic had reduced (P<.05) microscopic lower intestinal lesion scores. Vaccinated broilers had reduced (P<.07) relative lower intestinal weights at necropsy. These observations suggest that the administration of probiotic during coccidiosis vaccination can potentially stimulate immunity and improve intestinal health in broilers receiving clinical field strain Eimeria challenge.

Key Words: coccidiosis, vaccination, probiotic, challenge, broilers


Coccidiosis in chicken is caused by protozoan parasites of the genus Eimeria. Highly resistant environmental oocysts are ingested by the host animals, where sporozoites hatch, go through a complex life cycle with asexual and sexual stages, which are followed by formation and excretion of new oocysts.

Complete in vitro development in primary cell culture is possible, but yields are too low for continuous production of relevant parasite
numbers. Development in permanent cell lines is known to be even more limited. Among chicken coccidia, *E. tenella* with MDBK (Madin Darby bovine kidney) cells as hosts are the most frequently used cell culture model for in vitro research. The parasites develop readily until first generation merozoites, but further development is poor. Therefore, also in vitro studies require regular passage of *Eimeria* by host animals. Improvement of parasite development would result in more efficient use of parasite material in bioassays and other research and require fewer experimental animals. Eventually it might even assist in achieving complete in vitro cultivation in the future.

In order to optimize parasite development for future in vitro bioassays, a series of experiments was performed in cell culture. Different cultivation conditions for *E. tenella* in MDBK cells and media supplements were tested and assessed by quantification of first generation merozoites.

The amount of medium in culture dishes (96 well microplates) had most significant influence on parasite development. The reason is assumed to be less oxygen stress in cultures with higher medium supernatant.

Increased levels of fetal bovine serum (FBS) and GlutaMAX® (as a glutamine source) also positively influenced parasite numbers. These findings will be used for further in vitro experiments with *E. tenella*.

This work was funded by the EU project SAFEWASTES.

**Key Words:** coccidiosis, *Eimeria*, in vitro, optimization, medium

**P151 Onset and cessation of rigor mortis in layer hens.** K. Y. Williamson*, E. Benson, R. Alphin, C. Ciaverelli, and M. Rankin, University of Delaware, Newark.

In the poultry industry, table egg laying hens are kept in cages with up to 75,000 to 125,000 or more birds per house. The primary steps in response to an outbreak of highly infectious diseases such as avian influenza is surveillance, quarantine, depopulation, disposal, and disinfection. When birds infected or suspected of infection with highly infectious disease such as avian influenza, the birds must be depopulated in order to prevent the spread of the disease. Depopulation methods have been developed for floor reared meat type birds, but caged layers remain a problem. One of the critical questions is whether to depopulate the birds inside the cages or to remove the birds prior to depopulation. This experiment was conducted to determine the time window under which birds could be removed from cages. Birds were euthanized using two potential depopulation treatments, carbon dioxide gassing and water based foam. Temperature was controlled and multiple carcass measurements were collected to determine the onset of rigor. The results showed that there was a 1.5 hr initial time period in which the birds were flexible followed by a 3 hr period of rigor under which the carcass would be too stiff to easily remove from layer cages. The onset of rigor mortis was independent of depopulation method.

**Key Words:** rigor mortis, layers, depopulation, euthanasia

**P152 Meningoencephalitis in broilers associated to *Pseudomonas aeruginosa.*** C. C. Rosario1*, M. S. Gabilondo2, and M. T. H. Casaubon3, 1Departamento de Producción Animal: Aves, Universidad Nacional Autónoma de México, México, 2Avigrupo, Mexico.

Vaccination plays an important role in the poultry industry since it is the main strategy to prevent diseases within a flock. Several methods for the vaccination have been developed: drinking water, spray, eye drop, scarification and injection (intramuscular or subcutaneous). An automated machine that delivers high speed injections to chicken embryos was first used by manufacturers of human viral vaccine, and later, the design was adapted for use by the poultry industry. Administering live vaccines to a developing chick in the egg (in ovo) has proven to be a fast, effective, labor saving method, and, in some cases, a more rapid onset of immunity. However, the environmental conditions in poultry hatcheries that promote embryonic development also enhance proliferation of bacteria, which can cause disease in chicken flocks that could increase mortality. The aim of this abstract is to present a report case of meningoencephalitis in broilers. Ten twelve-day broilers showing severe nervous signs such as twisted necks, tremors or difficulty walking were submitted to the diagnostic area of the Poultry Department of the Veterinary School of UNAM (Mexico). At the time they arrived, two chicks had been died. All chicks were necropsied and no macroscopic lesions were observed, except several rounded granulomatous lesion (2mm to 7mm size) in the brain. Bacteriological isolation for aerobic and anaerobic bacteria and histopathological analysis using hematoxylin and eosin (H&E) stain were performed from the lesions of the brain. All samples were positive for the isolation of *Pseudomonas aeruginosa* in pure culture, which was confirm with the microscopic analysis of the lesions, where a suppurative meningoencephalitis was observed. These findings were important since the batch these chickens belong to were vaccinated *in ovo* at the hatchery. The high rate of diseased chicks suggests that a contamination could happen at the time they were vaccinated. Since no lesions were found in other organs, we hypothesize that intracranial inoculation with contaminated needles could be the origin of the problem.

**Key Words:** in ovo vaccination, broiler chickens, contamination, pseudomonas, hatchery

**P153 Determination of *Salmonella* persistence in shell and outer and inner shell membranes of hatching eggs disinfected with hydrogen peroxide.** J. Zamperio, I. Monroy-Becerra, J. A. Quintana-Lopez, and O. Urquiza-Bravo*, Universidad Nacional Autonoma de Mexico, Mexico City, Mexico.

Due to *Salmonella* contamination continues occupying an important place in infectious diseases transmission and one of the way for hatchery eggs disinfection is by using innocuous chemical substances like hydrogen peroxide, the objective of the present study was to determine the persistence of *Salmonella* in shell and outer and inner shell membranes of hatching eggs disinfected with hydrogen peroxide. Three treatments (T) of 17 hatching eggs each one were carried out. The *Salmonella* Enteritidis PT 13A inoculum had 109 CFU per ml concentration and 50 µl were impregnated in the shell, in the opposition pole of the air chamber, close to the embryo localization. The hydrogen peroxide concentration was 30%. The T1 consisted in: hatching eggs without *Salmonella* inoculation and no disinfection; T2: hatching eggs inoculated with *Salmonella* without disinfection; T3: hatching eggs inoculated with *Salmonella* and disinfection with hydrogen peroxide by aspersion. Samples were taken from the shell surfaces in the 3 treatments by cotton swabs. Later the content of each egg drained to take inner and outer shell membranes. All eggs were analyzed individually by a qualitative bacteriological test (Mexican official standardization (NOM-005-ZOO-1993)), which consisted in culture samples in Tetrathionate broth and green brilliant agar. The results were: T1. 100% (17/17) negative to *Salmonella* as shells as shell membranes. T2. 100% (17/17) positive to *Salmonella* from shells
and shell membranes. T3, 100% (17/17) negative to *Salmonella* isolation from the disinfected shells but 35% (6/17) of them were positive to the isolation of *Salmonella* from shell membranes, indicating that *Salmonella* was able to cross the pores of the shell in 2 hours postinoculation after disinfection with 30% concentration of hydrogen peroxide.

**Key Words:** hydrogen peroxide, *Salmonella*, disinfection, *Salmonella* contamination, egg shell contamination

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**P154**  
Molecular detection and characterization of infectious bursal disease virus (IBDV) variant strains from Venezuela. F. Perozo*1, A. Oviedo2, P. Villegas1, and L. Purvis1, 1University of Georgia, Athens, 2Servicio Autonomo de Sanidad Animal, Maracaibo, Zulia Venezuela.

Molecular detection and characterization of infectious bursal disease virus (IBDV) field isolates is a useful tool in IBDV control. The technique has become available worldwide thanks to new handling techniques that allow molecular genotyping and classification of disease causing viruses from countries lacking the necessary equipment and reagents to perform molecular technology. Classical IBDV is present in the Venezuelan poultry industry since the past century despite intensive vaccination programs are applied to control the disease. The presence of variant strains has been reported lately in several Latin-American countries. This work reports the molecular identification of variant IBDV strains in poultry farms from Venezuela. Bursal imprints in FTA cards and tissues for histopathological analysis were collected from 4-week old broiler flocks. Reverse transcriptase polymerase chain reaction (RT-PCR) and direct nucleotide sequence were used for the molecular characterization. All the farms sampled were IBDV positive. Viruses from seven out of eight farms showed high similarity with the IBDV variant strains used for comparison (variants A and E). Histopathological findings where consistent with the RT-PCR results showing IBDV related bursal damage. These results indicate the presence of IBDV variant strains in Venezuela where no live vaccination against these strains is currently allowed, increasing the risk for vaccine failure and the susceptibility to endemic diseases.

**Key Words:** genotyping, IBDV, Venezuela, variant strains

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**P155**  
Effects of time specific F-strain *Mycoplasma gallisepticum* inoculation overlays on prelay ts-11-strain *M. gallisepticum* vaccination on blood characteristics of commercial laying hens. E. D. Peebles3, A. M. Vance1, S. L. Branton2, S. D. Collier2, and P. D. Gerard1, 1Mississippi State University, Mississippi State, 2Poultry Research Unit, Agricultural Research Service, USDA, Mississippi State, MS, 3Clemson University, Clemson, SC.

Two trials were conducted to determine the effects of a prelay ts11-strain *M. gallisepticum* (ts11MG) vaccination alone or in conjunction with F-strain *M. gallisepticum* (F MG) inoculation overlays at 2 different age periods during lay on the digestive and reproductive organ characteristics of commercial egg-laying hens. In each trial, the following 4 treatments were utilized: sham vaccination at 10 wk of age; ts11MG vaccination at 10 wk of age; ts11MG at 10 wk of age overlaid by F MG inoculation at 22 wk of age; and ts11MG at 10 wk of age overlaid by F MG at 45 wk. Parameters measured in both trials were whole blood hematocrit, plasma protein, and serum cholesterol, triglycerides, and calcium. No significant age or treatment main affects or age by treatment interactions were observed for any of the blood parameters investigated, except for serum calcium. At wk 22, serum calcium levels were higher in birds vaccinated with ts-11MG at 10 wk compared to sham controls, and birds vaccinated with ts-11MG at 10 wk followed by an overlay of F MG at 22 wk were higher than controls and those vaccinated with ts-11MG at 10 wk alone. These results suggest that ts-11MG vaccination at 10 wk of age alone or combined with F-strain inoculum overlays at either 22 or 45 wk may be used without any consequential effects on hematocrit or the lipid and protein levels in the blood of commercial layers. Because elevations in serum calcium were not associated with changes in hen performance, as reported in a previous companion article, it is further suggested that prelay ts-11MG vaccination before F MG inoculation overlays during lay may provide adequate protection against field strain MG infections while being innocuous to layer performance.

**Key Words:** blood, commercial layer, F-strain *Mycoplasma gallisepticum*, ts-11-strain *Mycoplasma gallisepticum*, vaccination

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**P156**  
Effects of time specific F-strain *Mycoplasma gallisepticum* inoculation overlays on prelay ts11-strain *M. gallisepticum* vaccination on digestive and reproductive organ characteristics of commercial egg-laying hens. A. M. Vance1, S. L. Branton1, S. D. Collier1, P. D. Gerard2, and E. D. Peebles3, 1Poultry Research Unit, Agricultural Research Service, USDA, Mississippi State, MS, 2Clemson University, Clemson, SC, 3Mississippi State University, Mississippi State.

Two trials were conducted to determine the effects of a prelay ts11-strain *M. gallisepticum* (ts11MG) vaccination alone or in conjunction with F-strain *M. gallisepticum* (F MG) inoculation overlays at 2 different age periods during lay on the digestive and reproductive organ characteristics of commercial egg-laying hens. In each trial, the following 4 treatments were utilized: sham vaccination at 10 wk of age; ts11MG vaccination at 10 wk of age; ts11MG at 10 wk of age overlaid by F MG inoculation at 22 wk of age; and ts11MG at 10 wk of age overlaid by F MG at 45 wk of age. Necropsies were performed at the end of both trials (58 wk of age), using 2 birds per replication unit, to observe treatment effects on the following parameters: liver weight; liver lipid and moisture concentrations; incidence of fatty liver hemorrhagic syndrome; ovary weight; number of mature ovarian follicles; and the total and segmental weights, lengths, and histologies of the oviduct and small intestine. Treatments affected only vaginal length as a percentage of total oviduct length. Vaginas were relatively longer in hens that had only been vaccinated with ts11MG at 10 wk in comparison to all the other treatment groups, including controls. Except for relative vaginal length, the digestive and reproductive organs of layers were not influenced by the ts11MG and F MG treatment regimens imposed in this study. These results confirm that when coupled with F MG inoculations during lay, prelay ts11MG vaccinations may be a practical substitute for prelay F MG inoculations for providing continual protection against field-strain MG infections in layers.

**Key Words:** layer, liver, oviduct, small intestine, ts-11-strain *Mycoplasma gallisepticum*
This trial was conducted to study the effects of in ovo inoculation at d 18 of incubation on eggs of different weights. Blood was collected from 10 embryos to determine antibody levels against reovirus and avian bronchitis at d 18. Eggs were collected from a broiler breeder flock at 30 wk of age and separated into two groups, light and heavy eggs. These eggs were then incubated in the same machine. On d 18 of incubation the eggs were inoculated with solutions of Maltose, Vitamins, Zinc-Glicine, Glutamine, a mixture of all the solutions, and sodium chloride (control). The solutions were inoculated as Marek's vaccine diluter. After eclosion, 2460 male chicks were sent to the experimental farm and randomly allocated into 60 boxes. The chicks were then submitted to a factorial 2x6 (two egg weights and six solutions) design, totaling 12 treatments with 5 repetitions containing 40 chicks each. Blood samples of one bird per replication were collected and sent to a laboratory to determine antibody levels against reovirus and avian bronchitis at hatch and d 7 of age. Heavier eggs showed a trend (P<0.12 and P<0.11) of higher antibody levels for reovirus at d 18 of incubation and d 7 compared with lighter eggs (5.16 and 6.50; 5.14 and 5.81 for light and heavy eggs at 18 days and 7 days respectively on a logarithmic scale) but not at hatching (7.99 and 7.44 respectively). The inoculation of glutamine improved the antibody levels for reovirus at d 7 (6.58) relative to the control (3.56) and zinc inoculation (4.19) levels. The antibody levels of birds inoculated with zinc were also lower than those inoculated with Maltose (6.16), vitamins (6.12), and a mix of all solutions (6.22). No significant differences were found in the antibody levels for avian bronchitis in all ages. The inoculation of solutions in ovo using the in ovo vaccination machine could possibly improve the antibody levels of young birds. Heavier eggs seem to produce birds with higher antibody levels.

Key Words: in ovo nutrition, antibody levels, reovirus, avian bronchitis

P159  Chicken selenoprotein P response to viral infection as influenced by dietary selenium source.  J. Read-Snyder*SC1, F. W. Edens1, C. M. Ashwell1, A. Cantor2, and A. Pescatore2, 1Department of Poultry Science, North Carolina State University, Raleigh, 2University of Kentucky, Lexington.

Selenium (Se), an essential trace element, functions in the form of selenoproteins, and selenoprotein P (SelP) plays a role in Se transport, detoxification and antioxidant defense. Avian reovirus (ARV) infection can induce inflammatory responses in which oxidative activity is elevated. Se has an antiviral property against RNA viruses such as ARV. Thus, it is important to know how Se sources influence the expression of SelP in different tissues. Cobb 500 broiler breeder eggs were hatched and chicks were placed into two isolation rooms in brooder batteries and were given parental diets [isocaloric Torula yeast diets consisting either 1) no selenium (less than 0.02 ppm), 2) Sel-Plex (organic selenium {Alltech, Nicholasville, KY} 0.3 ppm) or 3) sodium selenite (0.3 ppm)]. Hatchlings were placed in three dietary treatments in either Control or ARV-Infected groups (30 per group). AVR-Infected groups were given orally ARV-CU98 (10^4.2 pfu/chick) and Control chicks were given sterile water. At 7, 14, and 21 days of age, five chicks per treatment group were killed and 500 mg of brain, thymus, pancreas, bursa of Fabricius, and liver were dissected and stored in RNALater at -20°C. Total RNA was extracted and subjected to real-time PCR assays developed for chicken SelP and 18s rRNA. Changes in gene expression were determined by the delta-delta-Ct method. The effects of treatment were determined by ANOVA. The individual differences in Ct ratio among different ages/diets/virus were significantly different (p<0.05). Overall, Se increased SelP expression regardless of source. In liver and brain, SelP expression decreased with age. SeP peaked at 14d in the pancreas, but the bursa SelP expression was lowest at 14d. Generally, there was a transitory increase in SelP expression at 7d in ARV-infected birds followed by decreasing SelP expression. Expression of SelP can be modified by viral infection regardless of Se source.

Key Words: selenium, selenoprotein P, broiler
P160  Degradation of dietary flavonoids by chicken cecal microbiota and biotransformation potential of different carbon sources. M. F. Iqbal*SC and W.-Y. Zhu, Nanjing Agricultural University, China.

In vitro and animal studies have demonstrated that flavonoids have antioxidant and antimutagenic activities. Flavonoid classes vary in their absorption and colonic bacteria can degrade the flavonoids to bioactive form. The aim of the present study was to investigate the potential of chicken microbiota in flavonoids breakdown and the influence of different carbon sources on their degradation into bioactive form. Using an in vitro fermentation system, metabolism of rutin, hesperidin, naringin, genistin and aglycones daidzein and formononetin were investigated. Culture medium was anaerobically incubated at 37°C for 72 h and substrate degradation and metabolite formation were determined by high-performance liquid chromatography. Cecal microflora was found to be active in the conversion of hesperidin and genistin into their aglyconic forms which were further degraded. No metabolites were detected after the fermentation tests with the diglucosidic compounds rutin and naringin and aglycones daidzein and formononetin. A new facultative anaerobic Lactobacillus delbrueckii like bacterial strain, capable of deglycosylation of the flavonoids, was brought into pure culture. To verify the effective bioavailability of flavonoid aglycones, the degradation rates of hesperidin and genistin, following incubation with selected strain, were monitored. Differences in the degradation patterns were observed for the tested flavonoids and considerable amounts of aglycones were accumulated within the first 12 h fermentation. The experiment was repeated with the addition of (1% (w/v) fructo-oligosaccharide (FOS) or organic acids as a carbon source to the fermentation medium. Fructooligosaccharide resulted in further rapid degradation of aglycone hesperitin. However, when organic acids (lactate, acetate or butyrate) were added, flavonoids degradation was suppressed indicating that the metabolic fate of flavonoids may be related to gut organic acids metabolism. The selected strain could also use flavonoid glycosides as external carbon source.

Key Words: carbon source, chicken cecal bacterium, aglycone production, flavonoid transformation

P161  Evaluation of mucosal development of the small intestine in perinatal turkeys by light and electron microscopy. D. V. Bohórquez*,1 A. A. Santos Jr.,2 and P. R. Ferken1, 1North Carolina State University, Raleigh, 2Florida Hospital College of Health Sciences, Orlando.

The morphology of the intestinal mucosa changes dramatically in the perinatal turkey as it shifts from a lipid-rich in ovo nutrient supply to a carbohydrate- and protein-rich diet after hatch. These changes in mucosal morphology and the associated gut function can be modified by dietary or microbial factors. To our knowledge, this is the first study that evaluates the ultrastructural changes that occurs in the small intestinal mucosa of perinatal turkeys. Scanning electron microscopy (SEM), transmission electron microscopy (TEM) and light microscopy (LM) observations were conducted to study the morphological development of the duodenum, jejunum, and ileum mucosa from embryos at 22E, 24E, 26E, and poult at hatch, 4, 8 and 11d. SEM and TEM observations were corroborated by histomorphometrical analysis made by LM. Villi topography and size profoundly changed between 22E and 24E, which coincided with the imbibing of amniotic fluid by the embryo. At 22E, the epithelial cell lining was not well-defined and microvilli were scattered, but by 24E the cell lining was well-attached and microvilli were uniformly distributed. SEM micrographs at 26E also revealed that the colonization of protozoa and bacteria in the ileum begins prior to hatch, although well-established colonies were only observed by 11d. Some of the bacteria identified at 11d were segmented filamentous bacteria, which are autochthonous organisms known to facilitate the mucosal development as well as the establishment of other non-pathogenic bacteria including lactobacilli. There was a dramatic 6-fold increase in villi surface area from 22E to 24E. Subsequently, villi surface area continued to double at each time point (26E, Hatch, 4d) until plateau at 8d. Villi morphology changed from finger-like projections before hatch to leaf-like projections after hatch. The profound morphological changes that occur over time in the small intestinal mucosa of perinatal turkeys may favor nutrient supply and the establishment of gut microflora.

Key Words: small intestinale mucosa, villi morphology, gut microflora, electron microscopy, perinatal turkeys

P162  Effect of high fat diet on broiler chicken performance. V. Durairaj*SC1,2, N. B. Anthony1, F. D. Clark1, W. E. Huff2, G. R. Huff2, and N. C. Rath2, 1University of Arkansas, Fayetteville, 2USDA/ARS PPSRU, Fayetteville, AR.

A previous study showed a link between elevated lipid levels and femoral head separation in broiler chickens, but a decrease in bone strength and a tendency for hepatic inflammation were not altered in high fat fed chickens, except an elevated level of alkaline phosphatase and decreased level of magnesium. The 15% fat fed chickens showed an accumulation of inflammatory cells such as heterophils in the liver. Body weight and incidence of femoral head separation were not altered in high fat fed chickens except an elevated level of alkaline phosphatase and decreased level of magnesium. The 15% fat fed chickens showed an accumulation of inflammatory cells such as heterophils in the liver. Body weight and incidence of femoral head separation were not altered in high fat fed chickens, but a decrease in bone strength and a tendency for hepatic inflammation was observed.

Key Words: high fat diet, femoral head separation, body mass index, bone strength, liver inflammation

P163  Response and resistance of several exotic pure chicken lines to heat stress by monitoring rectal temperature. A. Testik*, Cukurova University, Adana, Turkey.

The objective of this study was to determine the response, reaction and resistance of several chicken lines to heat stress by rectal temperature. The experiment was done at Experimental Poultry Farm of Cukurova University in Adana, Turkey. Animal materials of this experiment were 10 exotic chicken lines which are under improvement. These lines are; 2 brown sire, 4 brown dam, 2 white sire and 2 white dam lines.
Rectal temperature of the chicken lines were measured at different environmental temperatures of the poultry house. Test temperatures were between 27–39 °C with step size 1oC. The results indicated that there are statistically significant rectal temperature differences among some lines at various environmental temperatures in the poultry house.

In conclusion; response and resistance of these poultry lines to heat stress were different and it can be possible to obtain resistant hybrid types to heat stress from the convenient lines.

Key Words: hens, lines, stress, rectal, temperature

P164  Assessment of fertility and hatchability of Mexican wild turkey meleagris gallopavo intermedia eggs and artificially incubated. S. G. López*, J. Yañez, F. Cortez, and J. A. Quintana, 1FMVZ, Universidad Nacional Autonoma de México, México D.F. México, 2CIVS, SEMARNAT, México, Estado de México, México.

Currently wild turkeys is in risk of extinction due to influences by climate conditions, vegetation growth is scarce and it is insufficient for nesting and there is not enough food for females with their turkey chicks, there is increased pillaging of nests and brood. The above makes artificial incubation of eggs of this species necessary to increase the population of wild turkeys.

The objective of this study was to artificially incubate wild turkey eggs and detect the moment in which embryo deaths occurs during artificial incubation. Wild turkey eggs were received each week for seven weeks from a Wildlife Research Center located in the State of Mexico at 1,830 mosl. All eggs produced during the week were artificially incubated in Brinsea® brand incubators, at 2240 mosl, from day 1 to 21 at a temperature of 37.5°C with 55% humidity. Incubators were modified into hatchers during the first week as well as limb malformation of the embryo in the final incubation stage, and this suggests handling problems that protect the egg from contamination is possible that disinfection could destroy it and then allow later contamination. According to the results of this study, when carrying out this activity under field conditions suggests that disinfection treatment should not be applied to muscovy duck eggs before incubation. It is suggested that this study be repeated several times to carry out the respective statistical analysis.

Key Words: Cairina moschata, ducks, eggs, desinfection, contamination


When eggs are laid and handled, bacterial problems can happen due to improper handling of eggs during this critical period, mostly by contamination with pathogenic microorganisms. Disinfection of eggs before incubation has been implemented to avoid the penetration of the microorganisms into the egg. The objective of this study was to determine if egg disinfection increases or reduces bacterial contamination. Recently laid, 180 muscovy duck (Cairina moschata) fertile eggs were used placing 30 per each experimental Group, identified as follows: Group 1: Eggs washed with only water, Group 2: Eggs without washing, without disinfection, Group 3: Eggs washed with hot water and disinfection by aspersion, Group 4: Eggs without washing and disinfection by immersion, Group 5: Eggs without washing and disinfection by aspersion. A commercial disinfectant, Virkon S® that has a 40% glutaraldehyde base and 6% ammonium quaternaries was used at doses of one ml/liter of water. After 28 days of incubation, the number of contaminated eggs was established by smell. Contamination percentages of each experimental group were the following: Group one 5.56%, Group two 0.00%, Group three 11.11%, Group four 12.50%, Group five 16.67%. Since the surface of duck eggs has an oily layer as a cuticle that protects the egg from contamination it is possible that disinfection could destroy it and then allow later contamination. According to the results of this study, when carrying out this activity under field conditions suggests that disinfection treatment should not be applied to muscovy duck eggs before incubation. It is suggested that this study be repeated several times to carry out the respective statistical analysis.

Key Words: laying hen, fungi, rep-PCR
P167  Effects of acidic calcium sulfate + clay or diatomaceous earth litter formulations on broiler growth characteristics and against Salmonella in broilers.  E. L. Larrison*, SC1, M. A. Davis1, J. A. Byrd2, J. B. Carey1, and D. J. Caldwell1, 1Texas A&M University, College Station, 2USDA/SPARC, College Station, TX.

Research has shown that Salmonella can be prevalent in poultry litter, which can be a source of contamination for newly arrived chicks at the poultry house. Since this organism is a pathogen of concern to the poultry industry, two types of litter amendments were created and tested to determine effects on broiler growth, litter moisture and efficacy against Salmonella colonization. Litter amendments consisted of the combination of Acidic Calcium Sulfate (ACS) with either diatomaceous earth (DE) or hydrated sodium calcium aluminoisolate (HSCAS). Experimental conditions for broiler growth characteristics without the addition of Salmonella consisted of 9 pens in a growout house with each pen containing 15 broiler chicks per pen. Each litter amendment was applied to 3 pens for replicates of experimental groups. One set of 3 pens did not have a litter amendment applied for control. Experimental conditions for testing the efficacy against Salmonella consisted of 12 pens in 4 isolation rooms with 15 broiler chicks in each pen. Each litter amendment was applied to 3 pens for replicates of experimental groups. There were two control groups of 3 pens each consisting of Negative Control (no Salmonella or litter amendment) and Positive Control (Salmonella, no litter amendment). After litter amendment application, 150 ml of Salmonella solution at concentration 3.8 x 10^6 cfu/ml was applied to the litter for the two treatments and the positive control. Chicks were placed and growout time was 5.5 weeks. Litter samples were taken weekly from 5 areas in each pen and combined for determination of Salmonella counts. At 3 and 6 weeks post placement, 6 birds from each pen were euthanized by CO2 asphyxiation. The crop and ceca from these birds were tested for counts and/or presence/absence of Salmonella. Efficacy of the litter amendments varied in treatments on broiler growth characteristics and efficacy against Salmonella. Further research is planned to fully determine efficacy on Salmonella colonization and if this method is cost effective at the commercial level.

Key Words: broilers, Salmonella, feed conversion, litter, growth


The management pre-slaughter of broilers is probably one of the stages of the production chain which exerts greater influence on qualitative and quantitative indices of the proceeds from slaughterhouse. Thus, the objective of this research was to evaluate the effects of four periods (4, 8, 13 and 17 hours) of pre-slaughter fasting on the carcass yield and commercial cuts of broilers type Griller. On day 35, ten birds per treatment were slaughtered and were considered the variables: income from hot carcass (IHC) and cold (ICC), rate of absorption of water by the carcass and income from commercial cut. The body weight and hot carcass of broilers undergoing four hours of fasting was higher than that of birds subjected to other times of fasting. However there was no difference for the IHC between treatments. For cold carcass weight of only the periods of 4 and 17 hours of fasting differed significantly between them, but is now also for the ICC difference between the four periods of restriction. The carcasses of birds undergo the greatest time of fasting showed a higher rate of absorption of water after cooling. There were no significant differences in income from parts of carcasses of broilers. The loss of weight and weight of the carcass of broilers is proportional to the period of fasting. The duration of fasting has influence on the absorption of water by the carcass, but not on income, housing and commercial cuts.

Key Words: management, fasting, pre-slaughter, carcass yield, broiler performance

P169  Comparison of commercially available media in recovering Clostridium perfringens from poultry litter.  J. T. Krehling* and K. S. Macklin, Auburn University, Auburn, AL.

In times of disease outbreak, it is important to obtain an accurate count of litter bacterial numbers. One of the more important pathogenic bacteria found in litter is Clostridium perfringens. Several commercial media are available for the isolation and cultivation of C. perfringens. To date, studies aimed at determining the effectiveness of these media in recovering C. perfringens have been primarily targeted towards recovery from food products. In this experiment, we tested four differential media (OPSP, SPF, SPS, TSC) for their effectiveness in recovery of C. perfringens from poultry litter. Twelve litter samples taken from built up pens were collected and analyzed for recovery of C. perfringens. While recovery from pure culture comparisons yielded little difference, recovery from litter samples showed a trend towards TSC as a useful medium for enumeration. TSC gave the most consistent counts in nine out of twelve litter samples tested. We feel with it’s ability to keep background bacteria suppressed more so than the other media tested and it’s consistency in this study, TSC is the best medium for enumerating C. perfringens from poultry litter.

Key Words: litter, media, Clostridium perfringens


Protein source for poultry in rural areas in México is a large problem, since commercial protein sources are not available for low income producers, so alternatives are under study to counteract this problem. In order to analyze the nutritional content of seeds of some legumes such as wild mezquite (Prosopis laevigata), huizache (Acacia schaffneri) and algarrobo (Ceratonia siliqua) and a performance trial with broilers, using this seeds as protein sources. Proximal analysis was performed to determine: dry matter (DM), moisture, ash, crude protein (CP) and fatty acid profile. 64 day old Cobb chicks were assigned to a complete randomize design to the following treatments: Control (T1), mezquite (T2), huizache (T3) and algarrobo (T4), four replicates and four chicks by repetition. Performance was evaluated with weight gain, feed intake and feed conversion. The nutritional content of seeds was: mezquite, DM 92.46%, CP 39.0%, ash 5.09%; huizache DM 92.51%, CP 22.94%, ash 4.65%; and algarrobo DM 91.82%, CP 18.39%, ash 4.11%. The fatty acid profile for the mezquite was: 12.73% palmitic acid, stearic...
P171  **Effect of an anticoccidial disinfectant in the performance of broilers challenged with *Eimeria* spp.**  O. Ortiz-García¹, X. Hernández-Velasco⁵, B. Fuente-Martínez², R. V. Tejeda-Gil³, and A. Jasso-Villazul³. Departamento de Producción Animal: Aves (DPA; Aves), FMVZ, UNAM., México, D.F. México, ²Centro de Enseñanza, Investigación y Extensionismo en Producción Avícola (CEIEPAv), FMVZ, UNAM., Zapotitlán CP, México, DF. Mexico, ³Bayer de México, SA. de CV., México, DF, Mexico.

Avian coccidiosis is the most economically important parasite disease in the poultry production world wide. High resistance of *Eimeria* to the environment and to the common disinfectants is a determining factor in showing up and its persistence in the poultry farms. The aim of this study was to evaluate the effect of the treatment in the installations, with a specific disinfectant against coccidial parasites, on the productive parameters of broilers. We used two treatments: 1. chickens raised in a section of the farm treated with the anticoccidial disinfecting and; 2. (control group) chickens raised in a section treated with a general disinfectant. Each treatment consisted of 240 one-day born chicks in 6 replicas or pens with 40 chickens each one. Previous to the treatment with the disinfectant corresponding they were administrated 3,840,000 sporulated oocysts of *Eimeria* spp. The birds raised in the pens treated with the anticoccidial disinfectant did not show any difference (p≤0.05) in macroscopic intestine lesions, oocysts counts per gram of faeces, corporal weight, food conversion and food intake with regard to the group 2, except in the skin pigmentation (Tx 1. 27.69 ± 4.89 vs Tx2. 23.56 ± 3.42) (p≤0.05). The beforehand suggests an efficient action of the product over the *Eimeria* spp, which relates to a lesser challenge and damage in the intestine, and therefore to a better intestine health and absorption capacity; nevertheless, due to the low level of challenge, we did not observe differences in other productive variables.

**Key Words:** chick, legume, seeds, fatty acid, protein

P172  **A comparison of SAS programming statements and their impact on the interpretation of results of experiments with poultry.**  M. Y. Shim*⁶, L. Billard, and G. M. Pesti, University of Georgia, Athens.

Statistical analyses are important methods for interpreting results of agricultural experiments for scientific writing. Scientific writing should clearly communicate the particulars of the research being described in a way that it can be precisely repeated. Comparing differences between several treatments by the probabilities (p-values) that differences in means are due to chance is often described in articles in Poultry Science and related journals. Most data were subjected to ANOVA (analysis of variances) or regression models using the GLM (general linear models) procedure of SAS (statistical analysis software) program in articles to determine the p-values. There are several ways to program the SAS GLM procedure depending on the desired comparisons leading to quite different conclusions.

Data from a recent experiment was analyzed by several SAS GLM procedures to show how different SAS programming models can lead to different interpretations of the same data. Several ANOVA and regression models were computed with or without a *Class* statement that signifies classification variables. With the Class statement, SAS computes the SS (sums of squares) with n-1 degree of freedom where n is the levels of each independent variable. Without the Class statement, SAS computes the SS with only 1 degree of freedom, the regression model.

Two independent variables (x₁ and x₂) and one dependent variable (y) were analyzed. There were 6 levels of x₁ and 2 levels of x₂. Using either one-way ANOVA with Duncan's New Multiple Range Test or two-way ANOVA, no differences between treatments were detected. Using a linear regression model, x₂ and the x₁ × x₂ interaction term had significant p-values (0.0222 and 0.0103, respectively). For a second order polynomial regression model, only x₂ had a significant p-value (0.0279). When an ANOVA with components including linear and quadratic terms was computed, the interaction term between linear x₁ and x₂ had a significant p-value (0.0281).

The choice of design is important because conclusions from the subsequent analyses depend on the particular design used.

**Key Words:** ANOVA, regression, interaction, Duncan, SAS

P173  **House characteristics and energy utilization in poultry houses raising small broilers.**  D. G. Overhults¹, A. J. Pescatore*¹, R. S. Gates², J. P. Jacob¹, M. Miller³, and J. Earnest Jr.¹. ¹University of Kentucky, Lexington, ²University of Illinois, Urbana, ³Kentucky Poultry Federation, Winchester, KY.

An energy efficiency assessment was conducted on seven farms growing 1.8-kg broilers on a 36-d growout schedule. All houses were approximately 12-m x 157-m, with insulated dropped ceilings and tunnel ventilation. Houses on three farms had 60-cm sidewall curtain openings. On four farms, the sidewall curtain openings had been insulated and covered. All farms used propane-fired, forced-air heating systems with no radiant brooders. Total installed heating capacity was approximately 440 kW (1.5 million BTU/hr). All houses had either 8-9 120-cm or 130-cm tunnel ventilation fans.

For each farm, propane and electricity use were obtained for the calendar years 2006-07. Production records for the same time period were provided by the integrator. Annual propane use averaged 21,119 L/house with a range of 12,270 to 25,877 L/house. The average yearly electricity usage was 30,263 kWh/house with a range of 21,277 to 39,968 kWh/house. On a weight basis, propane use was 32.0 to 66.4 L/kg with a range of 12,270 to 25,877 L/house. The average yearly electricity was 1.0 to 100.1 kWh/kg with an average of 77.0 kWh/kg. For each farm, average yearly electricity usage was 30,263 kWh/house with a range of 21,277 to 39,968 kWh/house. On a weight basis, propane use was 32.0 to 66.4 L/kg with a range of 12,270 to 25,877 L/house. The average yearly electricity was 1.0 to 100.1 kWh/kg with an average of 77.0 kWh/kg.

Airspeeds during full tunnel ventilation were measured at bird level in 14 houses about 23 m upstream from the tunnel fans at four equally spaced locations. Mean airspeeds were 1.98 to 3.15 m/s with an average of 2.46 m/s for all farms. At each farm, a closed-house static pressure test was conducted.

**Key Words:** chick, legume, seeds, fatty acid, protein
conducted in one house. Fans for which in-situ performance data had been obtained were selected for this test, thus providing an estimate of the actual air leakage rate at the various static pressures recorded during the test. Sufficient data were available from five farms to estimate the air leakage rate. At a static pressure of 0.1 inches of water, estimated air leakage rates ranged from 27,558 to 47,739 m3/h.

Key Words: broiler houses, energy efficiency

P174  The Kentucky Poultry House Evaluation Service. D. G. Overhults1, A. J. Pescatore*1, R. S. Gates2, J. P. Jacob1, M. Miller3, and J. Earnest Jr.1, 1University of Kentucky, Lexington, 2University of Illinois, Urbana, 3Kentucky Poultry Federation, Winchester, KY.

The Kentucky Poultry House Evaluation Service (KPHES) is an ongoing project involving on-farm energy assessments for broilers raised in Kentucky. Objectives are to improve production efficiency by properly operating and maintaining equipment; to reduce energy costs by adopting energy-saving practices and installing cost-effective upgrades; to evaluate the cost effectiveness of potential house improvements; and to share with all growers of each integrator complex the information obtained from the evaluations.

Approximately 60 sites, 6-12 associated with each complex, will be selected for on-farm assessments. The assessment team examines the building envelope, heating system, lighting, ventilation system, static pressure inlet system, cooling and tunnel ventilation, environmental controls, and electrical service. Each producer receives a written report outlining potential improvements, energy savings potential, and estimated payback periods for possible upgrades. After completing the on-farm assessments within an integrator complex, results are presented to all complex growers focusing on typical problems found, energy efficiency practices recommended, and cost effective upgrades that could be implemented for producers with similar housing characteristics.

Work has been completed on 20 farms at two complexes and is underway at others. Some potential energy saving opportunities common to several farms already evaluated include adding attic insulation, closing and insulating sidewall curtains, installing attic air ventilation inlets, installing mixing fans, and changing from incandescent to compact fluorescent or cold cathode lighting. In most cases, estimated energy savings associated with these improvements provide simple payback periods of less than five years. Additional potential improvements were also identified but generally have longer projected payback periods.

Key Words: broiler houses, energy efficiency, energy audit

P175  Administration of Bacillus subtilis C-3102 (CALSPORIN®) spores plus glucose via drinking water of broiler chickens prior to slaughter to minimize weight loss during feed withdrawal and to reduce pathogen load. H. Horikawa1, K. Iwasaki1, H. Miyazaki1, T. Marubashi1, and D. M. Hooge*2, 1Calpis Co. Ltd, Tokyo, Japan, 2Hooge Consulting Service, Inc., Eagle Mountain, UT.

In Exp. 1, male broiler chickens (10/treatment x 3 treatments) from 48 to 51 d of age were given tap water or water plus an additive containing either Bacillus subtilis C-3102 (Bs C-3102) spores (CALSPORIN®; 6 x 107 cfu/mL water) and glucose (4% by weight) or glucose alone during the last 2 d of feeding and 1 d of feed withdrawal to determine BW change. The BW gain in the 2 d before feed withdrawal and the total BW gain over 3 d were both greatest in the group receiving the combination additive (Bs C-3102 plus glucose), with the glucose fed group’s BW gains being intermediate, and the tap water group’s BW gains being lowest. Birds given water plus Bs C-3102 and glucose had larger BW gain while being fed solid feed for 2 d than the birds given water plus glucose. A field study (Exp. 2) was conducted on broilers in paired houses beginning at 54 d of age. From each house during the pretrial period (i.e., before 54 d), 30 fresh fecal samples were collected, and the 2 flocks were shown to have no remarkable difference in the amount of Salmonella detected initially. On d 1 (54 d), birds had access to solid feed and either tap water or water plus Bs C-3102 and glucose (5% by weight). On d 2 (55 d), birds had access to tap water or treated water but no feed. Birds were caught for slaughter on d 3 (56 d), and 30 fresh fecal samples per house were collected. The combination treatment in water had 7/30 Salmonella positives and 3.98 ± 0.40 log10 cfu/g excreta whereas those given the tap water treatment had 18/30 Salmonella positives and 4.55 ± 0.66 log10 cfu/g excreta (positive sample means; P < 0.05). The mixture of Bs C-3102 and glucose (4% or 5% by weight) in water was effective at increasing BW gain during feeding, reducing BW loss during feed withdrawal, and reducing the proportion of Salmonella positive birds and their salmonella counts versus results with tap water.

Key Words: Bacillus subtilis C-3102, broiler chicken, Calsporin, feed withdrawal, Salmonella


Previously, we have intensely screened for environmental Bacillus isolates capable of utilization of ammonia as the sole-source of nitrogen, with high sporulation/spore stability characteristics. Two Bacillus isolates Bacillus subtilis/amyloliquefaciens (PHL-DW) and Bacillus cereus (PHL-CW) were presently evaluated for effects on BWG and Salmonella reduction in broiler chicks. Using a solid-state fermentation method we were able to produce spores greater than 1010 cfu/g. To test the ability of the probiotics to decrease Salmonella, the spores in the solid-state media were finely ground with a coffee grinder then mixed with feed using a Hobart-type mixer. Broiler chicks were fed feed containing either PHL-DW at concentrations of 104, 105, 106, 107, or PHL-CW at 106 cfu/sps/g feed from day-of-hatch throughout the study. Chicks were challenged with Salmonella typhimurium (ST) at day-of-hatch (108 cfu/chick by oral gavage). In experiment 1, the cecal tonsils were aseptically removed and cultured for the presence or absence of ST by enrichment 14 d post-challenge. There was a significant (p<0.05) reduction in percent ST-positive cecal tonsils from birds that were treated with Bacillus; DW 105 (43%), 106 (67%), 107 (33%), CW 106 (40%), as compared to non-treated controls (87%). In exp 2, a significant (p<0.05) reduction in ST-positive cecal tonsils from DW 107 (27%) was noted as compared with non-treated controls (80%) at 12 d post-challenge. No consistent effect of Bacillus treatment on body weight was observed in these experiments. While no direct effect of these Bacillus isolates on Salmonella growth was observed in vitro during preliminary experiments, results from the present study suggest that stable Bacillus spores capable of ammonia fixation may have beneficial probiotic effects on Salmonella colonization when provided at sufficient concentrations with continuous feeding.

Key Words: Bacillus, Salmonella, probiotic
P177 Interactions of probiotic administration and coccidiosis vaccine on avian mucosal immunity in broilers.  I. T. Lee*, 1 D. I. Caldwell1, M. Mohri2, R. Beltran2, G. Schatzmayr2, S. Fitz-Coy3, C. Broussard1, and M. B. Farrell1, 1Department of Poultry Science, AgriLife Research, Texas A&M University, College Station, 2Biomin GmbH, Herzogenburg, Austria, 3Intervet-Schering-Plough Animal Health, Millsboro, DE.

The oral administration of probiotics has been demonstrated to improve heterophil function, increase antibody titers, and enhance cell mediated immunity and reduce the incidence of pathogenic bacteria. The objective of the present study was to determine if the immune-potentiation of the avian gut with probiotic (Biomin® PoultryStar, Biomin GmbH) has an effect on coccidiosis vaccine (Coccivac®-B, Schering-Plough Animal Health) efficacy. Broilers were fed a conventional starter diet in experiment 1, while a diet with a slightly higher protein and amino acid profile which has been shown to improve broiler performance during coccidiosis vaccination was fed in experiment 2. Four hundred chicks were randomly divided into four treatment groups consisting of a negative control, probiotic, vaccine, and a combination of probiotic and vaccine. Blood was collected on day 7, 14, and 21. Four pools of peripheral blood were taken per group and immune cells were isolated with methylcellulose and discontinuous density gradients. Heterophil and mononuclear cell fractions were each assayed for oxidative burst using DCFDA, a fluorescent substrate. Lymphocyte proliferation was quantitated using WST-1, a formazan based colorimetric indicator. In Experiment 1, increases (P<0.05) were observed in all groups during the sampling period compared to the negative control in heterophil oxidative burst and lymphocyte proliferation, while monocyte oxidative burst was increased (P<0.05) in the combination probiotic and vaccine group. In experiment 2, increases (P<0.05) were observed in heterophil oxidative burst in all treatment groups and monocytes in the probiotic and probiotic plus vaccine treatment. Monocyte oxidative burst was increased in the vaccine group compared to the negative control. In the course of the two trials, the combination probiotic and vaccine group yielded increased immune cell function at multiple time points demonstrating an additive effect of the probiotic and coccidiosis vaccine. These data indicate the ability of probiotic bacteria and live oocyst vaccine to stimulate immune function in the avian mucosa.

Key Words: broilers, cornflakes wastes, performance, nutrient retention

P178 Effect of dietary levels of cornflakes waste on the performance and nutrient retention of finishing broilers in humid tropical environment.  S. O. Omoikhoje1*, E. T. E. Ehebha1, D. O. Obasoyo1, S. A. Atole1, and A. M. Bamgbose1, 1Department of Animal Science, Ambrose Alli University, Ekpoma, Edo State, Nigeria, 2Department of Animal Nutrition, University of Agriculture, Abeokuta, Ogun State, Nigeria, 3Bendel Feed and Flour Mill Ltd., Evu, Edo State, Nigeria.

One hundred and twenty Anak 2000 broiler chickens of twenty eight days old were used to assess the effect of replacing maize with cornflakes waste meal (CFWM) on their performance and nutrient retention. Five finisher diets (1, 2, 3, 4 and 5) were formulated and cornflakes waste meal was incorporated in the diets at concentrations of 0, 25, 50, 75 and 100% respectively. Each diet was fed to a triplicate group of twenty four broilers each ad libitum comprising eight chicks per replicate. From the results, daily weight gain was higher (P<0.05) in birds fed 75% CFWM than those, on other dietary treatments. In contrast, birds fed the control diet (0%CFWM) had higher (P<0.05) daily feed intake than those fed the CFWM based diets. Dietary inclusion of CFWM at 75% improved (P<0.05) the feed to gain ratio and protein efficiency ratio of birds compared to those on other dietary treatments. Apparent digestible dry matter, crude protein, crude fibre, ether extract, ash and nitrogen free extract were increased (P<0.05) as the dietary inclusion of CFWM increased from 0 to 75%. This suggests that CFWM can successfully be used to substitute maize up to 75% as a satisfactory energy source in broiler finisher diets with significant improvement in growth and nutrient retention.

Key Words: broilers, cornflakes wastes, performance, nutrient retention

P179 Performance comparison and lysine requirements of seven commercial brown egg layer strains during phase two.  P. K. Gunawardana*, D. A. Roland, and M. M. Bryant, Auburn University, Auburn, AL.

This study was a 3 × 7 factorial arrangement with 3 lysine levels (0.828, 0.747, and 0.680) and seven commercial brown egg layer strains. The objective of this experiment was to determine the effect of increasing dietary lysine on performance, egg composition, egg solids, egg quality and profits in seven commercial brown egg layer strains and to determine the lysine requirement during phase two (from 39 to 52 wk of age). This experiment lasted 14 weeks. Seven strains of hens (n = 240 of each strain) at 39 week of age were randomly divided into 21 treatments (8 replicates of 10 birds/treatment). The results showed that there were no interactions between lysine and strain on any parameter. Lysine had significant effects on feed consumption, egg production, egg mass, feed conversion, egg weight, shell components, percent yolk and whole egg solids, albumen and yolk weight, egg specific gravity, yolk color, and haugh unit. There were significant strain effects on feed consumption, egg mass, feed conversion, egg weight, albumen and yolk components, whole egg solids, albumen and shell weight, egg specific gravity, body weight, shell color, and haugh unit. Strain 1 had the best overall performance. All strains were laying 89.5 to 92.5% at 52 weeks of age. Average egg weight (39 wk to 52 wk) was 63 g, varying from 61.5 to 63.6 g between strains. Average feed intake was 112.1 g/hen/day varying from 108 to 114 g/hen/day between strains. Average egg weight of hens fed diets containing the highest lysine level was 3.38 g heavier than hens fed the diets containing the lowest lysine level. Increasing dietary lysine from 0.680 to 0.828% significantly improved feed conversion from 2.03 to 1.91 g feed/g egg and increased egg mass from 54.0 to 59.30 g/hen/day. Average lysine intake of hens fed 0.828% level was 939 mg/hen/day varying from 907 to 964 mg/hen/day between strains. Because egg and ingredient prices often change, there can be no fixed dietary lysine level for optimal profits.

Key Words: brown layer strain, lysine requirement, shell color


A study was conducted to test the effect of Dried Distillers Grains with Solubles (DDGS) dietary inclusion rates in SCWL pullet rations on feed intake, body weight and growth performance. Four hundred fifty
Hy-Line W-36 pullets were fed diets containing 0, 2.5, 5.0, 7.5, 10.0, or 12.5% DDGS from day-old to 16 weeks of age. The starter diet was formulated to provide 2950 Kcal/kg ME (Metabolizable Energy), and 20.0% Protein, and fed from day-old to 6 wks of age. The grower diet was fed from 7 to 9 wks of age and formulated to provide, 3000 Kcal/kg ME, and 18.0% Protein. The developer diet was formulated to provide, 3050 Kcal/kg ME, and 16.0% Protein, and fed from 10 to 15 weeks of age. The pre-lay diet was fed for one week (16) and formulated to provide, 3050 Kcal/kg ME and 17.0% Protein. The DDGS BPX® used to formulate the diet was provided from Dakota Gold® contained 2798 Kcal/kg ME and 26.7% crude protein. Fifteen chicks were placed per cage with 5 replicate cages per dietary treatment in a randomized complete block design. Feed intake and body weight were measured every week. Average feed intake was similar (p > 0.05) between treatments with a comparable feed intake to the Hy-Line W-36 manual. The overall avg. pullet weights were similar (p > 0.05) between dietary levels of DDGS. Time by treatment interaction was approaching significance (p = 0.07) for pullet weight. Pullets fed 12.5% DDGS had greater (p < 0.05) body weight compared to the other dietary treatments at 14, 15 and 16 weeks of age. There was no difference in overall pullet weight gain (p < 0.05) between treatments. Dietary treatments had no effect on the mortality rate with only 0.07% total mortality. In summary, feeding DDGS up to 12.5% had no negative affect on body weight, growth rate and feed intake. Body weight, growth rate, and feed intake are comparable to the Hy-Line breeding manuals.

Key Words: DDGS, dried distillers grains with solubles, pullets, Hy-Line


The experiment was conducted at the Agrarian Sciences Center of UFPR, Brazil. The aim was to evaluate the effect of proteic reduction in diets with supplementation of valine and metabolizable energy (ME) levels on broiler chickens performance from 1 to 42 days. Seven hundred and twenty male broiler chicks, Cobb, were distributed in a completely randomized design, in a factorial scheme 2 x 3 (two CP levels x three ME levels). To the treatments 1, 2 and 3, only L-Lysine, DL-Methionine and L-Threonine were added, which allowed CP to attend digestible amino acids (DAA) ratio, and the ME varied, -50, 0 and +50 kcal • kg⁻¹, respectively, according to the levels recommended by Rostagno et al. (2005). In treatments 4, 5 and 6, besides these amino acids, L-Valine was also added, resulting in a CP reduction until the level which attends the other DAA requirements, and ME was similar to that in the previous treatments. The evaluated variables were: feed intake (FI), weight gain (WG) and feed conversion ratio (FCR). No interaction between CP and ME levels was observed for the evaluated variables. FI from 35 to 42 days was higher (P<0.05) for birds receiving diets with greater CP without L-Valine supplementation. Except for FI during this phase, there was no significant effect (P>0.05) of dietetic CP on broiler chickens performance in none of the phases. On the other hand, ME levels influenced FI during the phases of 1 to 7 and 1 to 21 days (P<0.05), given the birds fed 50 kcal • kg⁻¹ short, presented greater FI. WG was also influenced (P<0.05) by dietetic ME levels, since birds fed 50 kcal • kg⁻¹ above requirements presented higher WG, in comparison to those submitted to diets formulated according to requirements or with 50 kcal • kg⁻¹ of ration below the requirements. Thus, one can affirm that it is possible to reduce diet CP with Valine supplementation without causing any harm to birds performance and that the increase in 50 kcal • kg⁻¹ of ME improved broilers performance.

Key Words: amino acid, crude protein, ideal protein, nutrition, requirement

P182 The distribution of crude protein and amino acid content in corn and soybean meal. N. Sripermn*1, G. M. Pesti1, and P. B. Tillman2, 1University of Georgia, Athens, 2Ajinomoto Heartland LLC, Chicago, IL.

This study examines the critical assumption of a normal distribution of crude protein and amino acid content in corn and soybean meal (SBM). Data were collected from the Ajinomoto Heartland LLC laboratory analysis database between 2002 and 2007. After outliers were removed, the numbers of crude protein and amino acid measurements were between 260 to 312 for corn and 442 to 533 for SBM. Tests of normality for crude protein (CP) and each amino acid were performed, for both feedstuffs, using the Shapiro-Wilk test. Histograms and correlation analysis between crude protein and amino acids were defined and investigated. Results indicated Methionine, Methionine plus Cysteine, Threonine, Valine, Arginine and Leucine were not normally distributed in corn (p < 0.05). In addition, crude protein and most of the amino acids (except Arginine and Leucine) were not normally distributed in SBM (p < 0.05). Linear relationships existed (p < 0.001) between CP and most of the amino acid levels in corn and SBM. The relationship between CP and Leucine for corn and CP and Isoleucine for SBM were found to be non-linear (significant quadratic terms at p < 0.05 and p < 0.0001, respectively). These results indicate a need for normality testing of ingredient nutrient compositions. Those nutrients which are not normally distributed may need to be represented in least-cost feed formulation by the median rather than the mean, especially for lysine in SBM. The data indicated a bi-phasic distribution of lysine in SBM suggesting perhaps some SBM samples may have been either under/over-processed or there are two distinct cultivars included in the dataset. It is suggested that mathematical formulation models may need to be adapted to incorporate distribution functions that better approximate nutrient levels in feedstuffs. The lack of normality in SBM data is of questionable importance for most amino acids as the means and medians were between 260 to 312 for corn and 442 to 533 for SBM. Tests of normality for crude protein (CP) and each amino acid were performed, for both feedstuffs, using the Shapiro-Wilk test. Histograms and correlation analysis of crude protein and amino acids were defined and investigated. Results indicated Methionine, Methionine plus Cysteine, Threonine, Valine, Arginine and Leucine were not normally distributed in corn (p < 0.05). In addition, crude protein and most of the amino acids (except Arginine and Leucine) were not normally distributed in SBM (p < 0.05). Linear relationships existed (p < 0.001) between CP and most of the amino acid levels in corn and SBM. The relationship between CP and Leucine for corn and CP and Isoleucine for SBM were found to be non-linear (significant quadratic terms at p < 0.05 and p < 0.0001, respectively). These results indicate a need for normality testing of ingredient nutrient compositions. Those nutrients which are not normally distributed may need to be represented in least-cost feed formulation by the median rather than the mean, especially for lysine in SBM. The data indicated a bi-phasic distribution of lysine in SBM suggesting perhaps some SBM samples may have been either under/over-processed or there are two distinct cultivars included in the dataset. It is suggested that mathematical formulation models may need to be adapted to incorporate distribution functions that better approximate nutrient levels in feedstuffs. The lack of normality in SBM data is of questionable importance for most amino acids as the means and medians were within 0.01%. However, the distribution of lysine in 442 SBM samples was obviously not normal with 277 samples between 2.69 and 3.00 and 165 samples between 3.10 and 3.48.

Key Words: amino acid, protein, corn, soybean meal, normal distribution

P183 Ileal digestibility of amino acids in feedstuffs for White Pekin ducks. C. Kong* and O. Adeola, Purdue University, West Lafayette, IN.

Two hundred eighty-eight White Pekin ducks were used in a 5-d trial to determine apparent ileal amino acid digestibility of various feed ingredients. Six feed ingredients including soybean meal (SBM), meat and bone meal (MBM), canola meal (CM), corn distillers’ dried grains with solubles (DDGS), corn, and wheat were used for study. The feed ingredients served as the sole source of amino acid in semipurified diets.
composed of dextrose, soy oil, solka floc, minerals and vitamins. The ducks received standard duck starter diet for 13 d from day 1 post-hatch and at day 14, were sorted by weight and allocated to 6 dietary treatments in a randomized complete block design. There were 8 replicate cages per treatment and 6 ducks per replicate cage. Beginning from day 14, ducks received the assay diet for 5 d and ileal digesta was collected on day 19. Ileal N digestibility was greatest (P < 0.01) in diet with SBM and the range was 72.4 (MBM) to 88.3% (SBM). Ileal amino acids digestibility was highest for SBM among the feed ingredients. Soybean meal had the greatest digestibility for lysine followed by CM, corn, wheat and MBM with DDGS being least digestible (P < 0.01). Methionine digestibility in SBM was greater (P < 0.01) than in corn, wheat, DDGS or CM, whereas MBM was the least digestible. For threonine, SBM had the highest digestibility and corn was the least digestible (P < 0.01), but there were no differences among other feed ingredients. The ranges in ileal amino acid digestibility were 69.2 (DDGS) to 90.3% (SBM) for lysine, 78.4 (MBM) to 91.8% (SBM) for methionine, 61.6 (corn) to 84.0% (SBM) for threonine, and 78.9 (MBM) to 93.0% (SBM) for tryptophan. In conclusion, there are considerable differences among protein sources in their ability to supply amino acid in a form utilizable by the duck. Therefore, more accurate diet formulation may be attained if digestible amino acids in a feed ingredient are taken into account.

Key Words: White Pekin ducks, amino acid, nitrogen, ileal digestibility, feed ingredient

P184 Effect of sex, protein and energy level on broiler carcass composition. B. L. Schneider*, M. J. Zuidhof, R. A. Renema, M. Betti, and V. L. Carney, Poultry Research Centre, Edmonton, AB, Canada.

As feed prices continue to rise, least cost formulation is routinely used to minimize input costs for the broiler industry. These diets may limit energy or protein to reduce the cost of a diet. To determine the effect of sex, dietary protein and energy level on carcass composition, 288 Cobb-Avian 48 broilers were raised sex-separately on one of 9 diets with one of 85, 100, or 115% dietary balanced protein (DBP) and one of 94, 97 or 100% of breeder recommended metabolizable energy (ME) levels. Eviscerated carcass fat, protein and ash were measured at 2 ages (42 and 52 d).

Males had higher percentages of carcass protein and ash than females (19.9% and 2.5% vs 19.2 and 2.3%, respectively), whereas females had significantly more carcass fat than males (11.0 vs 9.0%, respectively). Dietary ME affected all carcass composition traits. Reducing dietary ME below recommended levels resulted in lower carcass ash. The relative amount of carcass protein was highest in the 100% ME treatment, with no difference between the 97 and 94% ME treatments (19.7 vs 19.5 and 19.4%, respectively). Reducing ME below recommended levels resulted in significantly fatter carcasses (11.0, 9.7, and 9.3% carcass fat for 94, 97 and 100% ME, respectively). DBP had an interesting effect on carcass fat, with the lowest level in the 100% DBP treatment (9.6%). Providing DBP above or below the recommended level resulted in a significantly higher proportion of carcass fat (10.0 and 10.4%, respectively). DBP did not affect carcass protein. Although least cost diet formulation minimizes input costs, the effects of limiting dietary ME and/or DBP on carcass fatness may reduce the profitability of the broiler production system.

Key Words: dietary energy, dietary balanced protein, carcass composition, broiler


It has been suggested that Vitamin D3 stimulates an independent phosphate transport mechanism in the intestine, and improved absorption of phosphorus. The objective of this study was to examine if supplemental phytase and Vitamin E affect growth performance of chickens and also reduce phosphorus requirements. A completely randomised design experiment was conducted to examine the effect of dietary supplementation of microbial phytase (Natuphos 5000) and vitamin D3 on the performance, nutrient utilisation and ash contents of toe and tibiae of broiler finisher chickens. Two hundred and eighty eight 288 straight-run 21 day old Arbor Acre broiler chicks were divided randomly into 9 dietary treatments with 4 replicates, each replicate consisting of 8 birds. The dietary treatments were: a basal diet containing 20% crude protein with 3100 Mcal/kg DM ME without dicalcium phosphate (DCP)(negative control), basal + DCP (positive control), basal+ phytase at the rate of 350, 700, 1050 or 1400 FTU/kg and basal + vitamin D3 at the rate of 250, 750 and 1500 IU/kg, respectively. At the end of three weeks feeding trial, six birds from each treatment were slaughtered to determine the dressing percentage and meat yield. A digestibility trial was also conducted following the feeding trial to determine the apparent metabolisable energy (AME) and nutrient digestibility. Birds fed diets supplemented with either phytase or vitamin D3, showed similar performance to those fed diets adequate phosphorus. No difference was noted in the AME values and digestibility of DM, CP, Ca and P, among the dietary treatments. With the exception of the shank weight, dressing percentages and weights of internal organs were not influenced by phytase or vitamin D3 supplementation. Phosphorus excretion was reduced in the diets supplemented with phytase or vitamin D3. Toe and tibiae ash were higher in birds fed phytase or vitamin D3 compared to those fed diets adequate in P.

Key Words: phytase, vitamin D3, broiler, phosphorus, calcium

P186 Effect of Phyzyme® XP inclusion in low metabolizable energy, calcium and available phosphorus diets on broiler performance and markers of phosphorus utilization. A. Diaz*,1 S. Soderstrom1, E. Pierson2, M. Hruby3, A. Mireles3, and B. D. Humphrey1, 1California Polytechnic State University, San Luis Obispo, 2Danisco Animal Nutrition, St. Louis, MO, 3Foster Poultry Farms, Modesto, CA.

The objective of this experiment was to determine the effect of Phyzyme® XP 5000G Feed Phytase on broiler performance and markers of phosphorus utilization when in broilers fed diets with reduced metabolizable energy (ME), available phosphorus (avP) and calcium (Ca). One-day old straight run Cobb broilers were randomly assigned to one of eight replicate floor pens and provided one of four experimental diets. The positive control diet was formulated to meet or exceed NRC recommendations for the growing broiler chick. For each phase, the negative control (NC) diet contained reductions of 40 kcal/lb, ~ 10%, and ~ 25% in ME, Ca and avP, respectively. Phyzyme® XP was added to the negative control diet at an inclusion rate of 0.5%. All diets were fed as a mash. Differences between dietary treatments were maintained through all feeding phases. Feed intake, body weight, gain and mortality over the 43 day experimental period did not differ between dietary treatments (P>0.05). Phyzyme® XP addition to the negative control diet improved feed conversion, increased hot carcass weight, reduced
visceral weight and increased carcass yield compared to chicks fed the negative control diet (P<0.05). Phosphorus utilization was assessed by measuring bone strength and the mRNA abundance of the type IIB sodium phosphate (Nptb2) cotransporter in duodenal, jejunal and ileal mucosal scrapings by quantitative real-time PCR. Chicks fed NC diets containing Phyzyme® XP required greater tibia break force (kg) compared to chicks fed comparable nonsupplemented NC diets. The mRNA abundance of Nptb2 was highest in the duodenum (P<0.05). The negative control diet tended to increase Nptb2 mRNA abundance in the jejunal and ileum (P<0.2) compared to positive control and Phyzyme® negative control diet. The addition of Phyzyme® XP improved broiler performance and enhanced phosphorous utilization when included diets with reduced ME (40 kcal/lb), avP (0.12%) and Ca (0.10%) diets.

Key Words: energy, phosphorus, calcium, enzyme, gene expression

P187 Risk constrained programming: A visual basic for applications (VBA) excel spreadsheet program with solver for diet formulation. W. B. Roush* and S. L. Branton, USDA-ARS Poultry Research Unit, Mississippi State, MS.

A diet formulation program was written to take advantage of the advanced techniques available to developers of Excel spreadsheet programs and to encourage software developers to incorporate nonlinear programming in their mathematical programming packages. A menu driven program was developed in an Excel spreadsheet using Visual Basic for Applications (VBA). Solver served as the algorithm for linear program (LP) and stochastic program (SP) calculations. The menu consists of buttons for price, choosing ingredients, ingredient specifications, nutrient specifications, formulation, printing and exiting. Prices Button updates price information. Choose Ingredients Button produces a form from which ingredients can be chosen for the diet. Once the ingredients are highlighted, the choose ingredients button on the form is activated and the ingredients chosen with the accompanying information are transferred (by a transfer macro) to the LP and SP menus for formulation. Ingredient Specifications Button indicates restriction to be placed on ingredients. That is, definition of the chosen ingredient level as a minimum, maximum or equality. Nutrient Specifications Button shows the nutrients of interest, the requested requirement and the requested level of probability for meeting the requested requirement. The Formulation Button activates the solver algorithm to calculate the LP and SP formulations. The screen is transferred to a summary window that simultaneously shows the results of the formulation. The Print Button sends the results to the printer. The Exit Button terminates the program. SP has been shown to improve the accuracy and precision of diet formulation with variable ingredients (e.g., Distillers Dried Grains). The menu driven Excel program with VBA allows the nutritionist to formulate and compare results of diets formulated with LP and SP in an atmosphere that does not resemble the traditional spreadsheet program.

Key Words: visual basic for applications, diet formulation, linear programming, stochastic programming

P188 Use of pecan fiber to enhance non-feed withdrawal molting programs. N. M. Dale*, University of Georgia, Athens, GA.

During the past 5 years there has been increasing interest in the use of high-fiber diets as an alternative to fasting in molting programs for laying hens. The objective of such diets is to reduce metabolizable energy (ME) intake, and by doing so achieve a reduction in body weight and a cessation of egg production without resorting to complete feed withdrawal. Pecan fiber (PF) (the red-brown layer immediately inside the pecan hull) has been suggested as an ingredient to amplify the reduction in energy intake achieved with high-fiber diets. Three studies were conducted as an initial assessment of this hypothesis.

In the first study 0, 3, 6 and 9% PF were added to a commercial layer ration for a period of 6 days. Feed intake was negatively correlated with degree of inclusion of PF, and returned to pre-treatment levels immediately after withdrawal of the ingredient. The second study consisted of four treatments: a commercial layer ration (2820 kcal/kg) as a positive control, a high-fiber, low ME ration (1760 kcal/kg) as negative control, and either 5 or 10% PF added to the negative control. Once feed consumption stabilized after 7 days, daily ME intakes were 290 kcal/bird in the positive controls, 215 kcal/bird for the high-fiber treatment, and 107 and 72 kcal/bird in the 5 and 10% PF treatments, respectively. In the third study 0, 3, 6, 9,12, or 15% PF were added to the high-fiber ration, with daily ME intakes of 136, 125, 118, 75, and 41 kcal/bird, respectively, after 7 days treatment. This led to body weight losses of 14.7, 15.2, 16.0, 19.3, 23.8 and 26.9% in the respective treatments. In the 9, 12, and 15% PF treatments, a cessation of egg production was observed after 6 days feeding.

It is concluded that Pecan Fiber is an effective means of reducing caloric intake in laying hens, and has the potential to make a significant contribution to non-feed withdrawal molting programs. On the basis of these studies, testing under commercial conditions appears to be warranted.

Key Words: pecan fiber, non-feed withdrawal molting, laying hens


An experiment was conducted to evaluate the effects of feeding reduced levels of trace mineral in proteinate form (Bioplex®, Alltech, Inc.) on white layer pullet development. Eight replicate groups of 16 replacement pullets, 1-day of age, were randomly assigned to each of five dietary treatments. Pullets were housed in cages and given ad libitum access to feed and water. Treatments consisted of feeding corn-soybean meal-based starter and grower diets alone (control), supplemented with Cu, Mn, Fe and Zn at 25, 50 or 100 per cent of the NRC (1994) requirements in the form of proteinates or 100 per cent of the NRC requirements in the form of inorganic salts. The excreta samples were collected at week 15 of bird age. At 17 wk of age, the trial was ended. The birds were weighed individually for the measurement of uniformity. A total of 10 birds from each treatment were randomly selected for collection of liver and tibia samples. The concentration of Cu, Mn and Zn in the tissue and excreta samples was analyzed. There were no differences among all dietary treatments in body weight, feed intake, uniformity and liver mineral content. The tibias and excreta samples from birds fed control diet with no mineral supplementation had significantly lower (P<0.01) Zn and Mn concentration than those from birds fed other diets. The tibias from birds fed 100% NRC level of supplementation as Bioplex® had higher (P<0.01) Mn concentration than those from birds fed 25% NRC level of supplementation as Bioplex®. The excreta samples from birds fed 25% level of supplementation as Bioplex® had lower (P<0.01) Zn and Mn concentration than those from the birds fed other diets except control diet. The results indicate that 25% NRC
level of supplementation as Bioplex® in pullet diets can reduce the mineral excretion, but has no negative influence on performance and tissue mineral concentration in comparison with 100% NRC level of supplementation as inorganic salts.

**Key Words:** pullet, trace minerals, organic minerals, proteinate

**P190** Effect of enzyme supplementation on the nitrogen digestibility of laying and meat type cockerels fed tomato by-products. M. Radfar1, B. Mansoori2, A. Sheikhlar1, M. Modirsaner1, and M. M. Kiaei2, 1University Putra Malaysia, Serdang, Selangor, Malaysia, 2University of Tehran, Iran.

This experiment was carried out to determine the influence of dietary enzymes, avizyme 1502 and grindazyme 15000 GP, on uric acid output and true nitrogen digestibility of dried tomato pomace (DTP) in laying and meat type cockerels, using force-feeding technique. Twenty eight 8-week-old meat type cockerels (Ross 308) and twenty 35-week-old laying type cockerels (Hy-line W-36) were distributed into four groups of seven and five birds, respectively. After 24h of fasting, each bird was force fed with one of the following test materials, 50ml glucose solution (0.6 g/ml, control group), DTP alone (30 g), DTP and avizyme (30 g +20 mg) and DTP and grindazyme (30 g +10 mg). The voided excreta were collected for 48 hours and dried. Nitrogen content of DTP and excreta samples as well as the uric acid content of excreta was measured. Feeding DTP increased (p<0.001) the total nitrogen and uric acid output of the experimental birds. Enzymes had no effect on the excretion and/or digestibility of DTP nitrogen in laying type cockerels. However, meat type cockerels showed a lower uric acid output and higher DTP nitrogen digestibility when both dietary enzymes were used.

In conclusion, the addition of dietary enzymes might benefit the meat type bird as well as the environment by enhancing the digestion and utilization of DTP by the bird and reducing the excretion of undigested nitrogen.

**Key Words:** feed enzyme, nitrogen digestibility, tomato by-products, uric acid

**P191** Efficacy of a novel feed protease on a variety of protein ingredients. M. Fischer1, V. Glitsoe1, D. Pettersson1, and F. Fru2, 1Novozymes A/S, Bagsvaerd, Denmark, 2DSM Nutritional Products, Basel, Switzerland.

A novel monocomponent feed protease (RONOZYME®ProAct) was evaluated in an in vitro digestion model simulating the gastrointestinal system of monogastric animals. The ability of the protease to increase protein solubilization and the proportion of free amino acids from broiler diets and protein rich feed ingredients was evaluated. The samples were incubated without (controls) and with protease supplementation in a stomach step (pH 3) followed by addition of pancreatic enzymes in an intestinal step (pH 6.8). The controls were used to correct the results for the effect brought about by the endogenous digestive enzymes. Each treatment had five replicates.

The efficacy of the feed protease was tested on two commercial broiler diets based on soybean meal, maize and meat and bone meal. Moreover, different feed ingredients (meat and bone meal, maize, sorghum, feather meal, full fat soybean meal and defatted soybean meal) with varying protein content were tested separately. From all ingredients, the solubilization of crude protein (N×6.25) was increased (range 1 to 15%) by the feed protease. Effects were highest for meat and bone meal, maize and grain sorghum (8, 10 and 15%, respectively). Furthermore, the proportion of free amino ends, as determined by the Degree of Protein Hydrolysis, was increased (range 3 to 27%) for all ingredients, compared to the controls.

In conclusion, the results demonstrated a strong ability of RONOZYME® ProAct to increase protein solubilization and the degree of protein hydrolysis in vitro for a range of feed ingredients. Thereby, this protease has the potential to improve the utilization of protein rich feed ingredients in animal production.

**Key Words:** protein, protease, monocomponent, utilization


Allzyme SSF® is a naturally fermented complex capable of increasing release of phytate-bound phosphorus, calcium, energy and amino acids from poultry feed. In order to investigate the effect of Allzyme SSF® on the performance of chicks fed low phosphorus diet, a total of 192 chicks was raised for three weeks by using the following treatment diets: 1) corn-soy positive control diet containing 0.45% available phosphorus; 2) corn-soy negative control diet containing 0.25% available phosphorus; 3) Diet 2 + 400 g Allzyme SSF® / Ton; 4) Diet 2 + 600 g Allzyme SSF® / Ton. Eight replicate cages of six chicks were randomly assigned to each of four dietary treatments. Chicks were housed in starter cages in an environmentally controlled room with an ad libitum access to feed and water. Chicks fed the low phosphorus negative control diet had lower (P<0.01) weight gain and feed intake compared with other dietary treatment groups and had lower (P<0.01) gain to feed ratio compared with chicks fed diet with supplementation of 600 g Allzyme SSF® / Ton in the entire experimental period. Dietary supplementation of Allzyme SSF® in the low phosphorus basal diet significantly increased (P<0.01) weight gain, feed intake and gain to feed ratio. Data from this trial indicate that supplementation of Allzyme SSF® in corn-soy based poultry diets can improve phosphorus utilization.

**Key Words:** chick, phosphorus, enzyme

**P193** Improvement in commercial pellet mill throughput with dietary AZOMITE® Micronized in turkey feeds or with dietary builders' sand or AZOMITE® Feed-Grit in broiler chicken feeds. W. W. Emerson1 and D. M. Hooge*, 1Peak Minerals - Azomite, Inc., Kansas City, MO, 1Hooge Consulting Service, Inc., Eagle Mountain, UT.

A hydrated sodium-calcium aluminosilicate or HSCAS (AZOMITE®, Peak Minerals - Azomite, Inc., Kansas City, MO) from a volcanic ash deposit in Utah may provide several benefits in broiler chicken feeds including mycotoxin binding and improved BW, feed conversion ratio, livability, carcass yield, and breast meat yield. The product typically contains 75 of 92 naturally occurring elements and is listed by OMRI® for use in organic feeds. As an HSCAS, it is FDA approved as an anti-caking (flow) agent at levels up to 2% in feeds; however, recommended
practical levels of inclusion are about 0.5% to 0.3%, starter to finisher, in broiler and turkey feeds. In a pellet mill test (Trial 1) with 8 turkey feed formulas ranging from 15% to 28% protein, and using 0 or 1% (AZOMITE®) Micronized (-200 mesh), the supplement increased conditioned mash temperature (+3.4°C or +6.1°C; P = 0.006), decreased amps (-9.4 amps; P = 0.011), and increased % pellets (+3.6% actual; P = 0.030) with similar pellet durability indexes (+0.4% PDI; P = 0.489). Trials 2-4 were with broiler feeds. In Trial 2, either 0.0, 0.5, or 1.0% levels of AZOMITE® Feed-Grit (about 70% coarse -8 mesh, 30% fine -50 mesh) were used. Throughput increased (+3.0 and +2.8 tons/hr, respectively; P = 0.000) with 0.5 and 1.0% levels vs 0%. In Trial 3, there were 22 (3.5-ton) batches with 0%, 27 batches with 0.4% AZOMITE® Feed-Grit, and 14 batches with 0.4% builders' sand, always keeping throughput constant at 28 tons/h. The % pellets increased (+4.6% actual; P = 0.000) but amps also increased with phosphate plus either AZOMITE® or sand supplement. In Trial 4, using phytase, phosphate was reduced (0 vs 0.20%), meat and bone meal increased (3.29 vs 2.02%), along with 0 or 0.5% AZOMITE® Feed-Grit (5 x 5-ton batches of each). Throughput increased (45 vs 30 tons/h) and electrical efficiency improved (8.7 vs 12.7 amps/ton-h) due to the supplement. AZOMITE® increased pellet mill throughput under commercial conditions.

Key Words: azomite, builders' sand, hydrated aluminosilicate, pelleting, throughput

P194 Determination of true metabolizable energy using intact roosters and amino acid availability using cecemcized roosters of corn gluten (45% crude protein) from a new process that separates corn germ and endosperm prior to ethanol production. T. Lohrmann1 and D. M. Hooge2, 1Quality Technology International, Inc., Elgin, IL, 2Hooge Consulting Service, Inc., Eagle Mountain, UT.

A new corn ethanol wet fractionation system provides a uniform, high quality co-product, similar to corn gluten meal, known as “flash dried” Glutenol® (45% crude protein, 3.9% crude fat, 0.7% phosphorus), suitable for use in poultry and livestock feeds, and pet foods. Ingredient matrix values needed to be developed so 2 universities performed similar assays. University 1 (U1) used 4 adult Leghorn ceca-intact rooster per sample for true metabolizable energy N-corrected (TME) testing and 4 cecemized roosters for true amino acid availability (TAAA) testing. University 2 (U2) used 10 adult Leghorn ceca-intact roosters per sample for TME testing and 8 cecemized roosters for TAAA testing. University of Missouri laboratory performed amino acid tests for all ingredient and excreta samples to improve consistency of data. Gross energy (GE, 10% moisture) content of Glutenol® samples was 10,758 kcal/kg at U1 and 10,865 kcal/kg at U2. The TME was 3,210 kcal/kg (1,457 kcal/lb) at U1 and 3,236 kcal/kg (1,471 kcal/lb) at U2, amounting to 65.8 and 65.7% TME/GE, respectively. Overall mean TME for Glutenol® was 3,233 kcal/kg (1,462 kcal/lb). Using NRC (1994) ratio of 97.6% for corn gluten meal MEn/TME, the MEn for Glutenol® is estimated at 3,155 kcal/kg (1,315 kcal/lb). Soybean meal (SBM) and DDGS samples averaged 2,676 and 3,074 kcal/kg MEn/kg, respectively. The TAAA for Glutenol® (3,223 kcal/kg) is greater than that of SBM (2,676 kcal/kg) or DDGS (3,074 kcal/kg) and TAAA (86.86%) is at least as good as or higher than commodity DDGS (82.53%).

Key Words: amino acid availability, cecemizized, Glutenol, rooster, TME


The study was designed to determine the effect of Zn and Mn supplementation from Availa-Zn and Availa-Mn on egg quality parameters in white leghorn hens from 45-85 weeks of age. A Corn-soy based diet was formulated to be isocaloric (2790 kcal/kg) and isonitrogenous (18.6%) with four dietary treatments. Diet 1 was formulated to have 60 ppm of Zn from ZnO and 60 ppm Mn from MnSO4. Diet 2 received 20 ppm of Zn from ZnO and 40 ppm of Zn from Availa-Zn and 60 ppm Mn from MnSO4. Diet 3 was supplemented with 60 ppm Zn from ZnO and 40 ppm from Availa-Zn and 60 ppm Mn from MnSO4. Diet 4 was similar to the third with the addition of 40 ppm of Mn from Availa-Mn. Each treatment was replicated eight times and fed to four hens per cage. Feeding laying hen's diet supplemented with Zn and Mn significantly increased feed intake at all levels compared to diet 1 (p<0.05) with no difference in body weight gain. Egg production did not show any significant difference with addition of Zn or Mn. There was a significant increase in egg wt. between diet 1 and diet 2 supplemental Zn at 20 ppm from ZnO and 40 ppm from Availa-Zn (p<0.05), however the overall treatment effect was not significant. Supplemental levels of Zn and Mn had no significant effect on percent dry shell, wet shell, albumen and haugh unit. There was a significant decrease (p<0.05) in yolk weight with Availa Zn at 40 ppm and 60 ppm of Zinc oxide (diet 3) compared to diet 1. The addition of Zn had a significant effect (p<0.05) on specific gravity with the estimates being higher at 40 ppm Zn from Availa-Zn and 60ppm of Zinc oxide (diet 3) compared to diet 1 in addition to the larger egg size without any effect of Mn supplementation. The inclusion of Zn or Mn in the basal diet did not reduce the incidence of cracked, dirty, undergrade eggs or improve feather score. Supplementation of Zn improved feed intake at all levels and yolk weight as well as specific gravity seems to be affected at higher levels. Similarly, inclusion of Mn also improved feed intake without any effect on egg quality parameters.

Key Words: zinc, manganese, egg quality, laying hens

P196 Using biochemical characterisation to compare phytases. K. Pontoppidan1, V. Glitsoe1, P. Philippse1, and N. Ward1, 1Novozymes A/S, Bagsvaerd, Denmark, 2DSM Nutritional Products, Saint-Louis Cedex, France, 3DSM Nutritional Products, Parsippany, NJ.

It is generally acknowledged that feeding trials are the only way to fully understand the potential of a feed enzyme. However, due to the lack of suitable alternatives biochemical characterizations are often used to predict the performance of phytases at an early point in the discovery phase, even though simple enzyme activity assays cannot be expected to fully depict the environment or processes of the gastro-intestinal tract. Phytase activity is normally assayed using purified Na-phytate as a substrate. In contrast, phytate in the digestive tract occurs as part of a
complex feed matrix, and due to the strong chelating ability of phytate, it is associated with proteins and minerals that affect the solubility of phytate. Phytate solubility and phytase activity of a fungal phytase (P. lyticus) were assayed at pH 2-10 using either Na-phytate or feed phytate (in a soybean meal/corn diet) as substrate. Phytate solubility in the feed matrix was very pH dependent with increased solubility from pH 3 to pH 4.5, whereas at pH 6 feed phytate was largely insoluble. The P. lyticus phytase activity profile was shifted towards lower pH when feed phytate was used as a substrate rather than Na-phytate, indicating the importance of phytate solubility.

Phytase stability and activity at very low stomach pH is sometimes claimed to be a prerequisite for phytate degradation in vivo. However, the conditions chosen to mimic stomach conditions largely determine the results. More over, the gastro-intestinal site of phytate degradation in poultry has not been sufficiently investigated and phytate degradation may occur in the crop, thereby decreasing the importance of phytase stability and activity at low pH. The degradation of phytate in broilers was monitored by sampling the digesta from crop, gizzard and small intestine. P. lyticus phytase degraded considerably more phytate in the crop than an E. coli phytase did (80.1% vs 37.4% compared to control animals; p<0.05). Hence, depending on the enzyme activity profile, phytate degradation can occur at various parts of the digestive tract.

Key Words: phytase, phytate, broilers, intestine, characterization

P197 The effect of commercial enzymes and their dose on broiler performance. J. C. C. Carvalho*, 1 V. A. Costa1, R. L. Dari2, M. S. Cunha1, and A. G. Bertechini1, 1Universidade Federal de Lavras, Minas Gerais, Brazil, 2Nutron Alimentos Ltda, Campinas, SP, Brazil, 3Danisco Animal Nutrition, Campinas, SP, Brazil.

A search for ways to better utilize nutrients and, in particular, energy in feedstuffs, provides opportunities for greater incorporation of exogenous (feed) enzymes in poultry feeds. A 42-day study was conducted to evaluate the effect of two different commercial enzymes at two doses on broiler performance. The dietary treatments used were: 1) positive control (PC) corn and soybean meal-based diet with meat and bone meal without enzymes; 2) negative control (NC) with ME reduction of 60 kcal/kg from 8 to 21 days of age and 120 kcal/kg reduction from 22 days till slaughter; 3) and 4) NC plus 0.05% and 0.1% of commercial enzyme A (600 units endo-xylanase/g, 8000 units subtilisin protease/g and 800 units α-amylase/g), respectively; 5) and 6) NC plus 0.05% and 0.03% of commercial enzyme B (200 kNU α-amylase/g and 350 FBG β-glucanase/g), respectively. The completely randomized experimental design contained six diets and eight replicates of 32 Cobb 500 male broilers. At 21 days of age, broilers fed the NC diets had significantly (P<0.05) poorer weight gain (WG) and feed conversion (FC) compared to birds fed the PC diet. Both enzyme products improved WG significantly. At 42 days of age, the PC and the enzyme products, regardless of dose, provided better WG and FC than the NC. Both WG and FC of broilers supplemented with 0.05% of the enzyme products were similar to those obtained with the PC. At the 0.03% level of inclusion neither of the enzyme products was able to give broiler performance equivalent to the PC level. The use of both enzyme products reduced production costs per kg of 42-day live weight. Both enzyme products improved response in broiler diets with reduced ME, however, their effect was dose-dependent.

Key Words: enzymes, broiler, corn-based diet, dose, performance


The experiment was conducted at the Agrarian Sciences Center of UF PB, Areia, PB, Brazil. The aim was to evaluate the effect of proteic reduction in diets with Valine and metabolizable energy (ME) supplementation on broiler chickens carcass yield at 42 days. Seven hundred and twenty male broiler chicks, Cobb, were distributed in a completely randomized design, in a factorial scheme 2 x 3 (two CP levels x three ME levels). To the treatments 1, 2 and 3, only L-Lysine, DL-Methionine and L-Threonine were added, which allowed CP to attend digestible amino acids (DAA) ratio, and the ME varied, -50, 0 and +50 kcal/kg, respectively, according to the levels recommended by Rostagno et al. (2005). In treatments 4, 5 and 6, besides these amino acids, L-Valine was also added, resulting in a CP reduction until the level which attends the other DAA requirements, and ME was similar to that in the previous treatments. At 42 days of age, 2 birds per experimental unit, with representative parcel weight, were selected and after 8 hours of fasting, were sacrificed by cervical dislocation. Bleeding, depumling, evisceration and cutting were performed. Cuts were weighed in digital balance. Evaluated variables were: carcass, breast, thigh, drumstick and wing weight (g) and yield (%), and heart, gizzard and liver absolute (g) and relative (%) weight. Carcass yield was calculated in relation to the live fast weight, and cuts yield, in relation to carcass weight. Relative organ weight was calculated in relation to live fast weight. There was no interaction (P>0.05) between CP and ME for any of the evaluated parameters. Similarly, weight and yield of carcass and cuts, and organ absolute and relative weight were not influenced (P>0.05) by CP and ME separately. Therefore, on can conclude that diet CP reduction, with Valine supplementation, and decrease or increase of 50 kcal ME/kg to the requirements do not alter carcass and parts yield of broiler chickens.

Key Words: amino acids, crude protein, ideal protein, performance, requirement


The experiment was conducted at the Agrarian Sciences Center of UF PB, Areia, PB, Brazil. The aim was to evaluate the effect of crude protein (CP) levels and of diet essential: non essential amino acids ratio (EAA:NEAA) on broiler chickens performance from 8 to 21 days. Four hundred and eighty male broiler chicks, Cobb, were distributed in a completely randomized design, with four treatments and six replicates with 20 birds. An 18% CP diet was formulated, supplemented with lysine, methionine, threonine, arginine, valine, isoleucine, glycine and tryptophan, in order to attend digestible amino acids (AA) requirements. After formulation, the EAA supply in total AA (TAA) was verified and the ratio with the level of CP of the ration was calculated. It was considered as EAA: lysine, methionine + cystine, threonine, arginine, valine, tryptophan, isoleucine, leucine, phenylalanine, histidine and glycine. The other treatments were formed from glutamate supplementation in order to reach the levels of 19, 20 and 21% of CP. Starch, oil and inert were used in the diets to make them isonertetic. EAA:NEAA ratios of

The experiment was conducted at the Agrarian Sciences Center of UF PB, Areia â€“ PB, Brazil. The aim was to evaluate the effect of crude protein (CP) levels and of diet essential:non essential amino acids ratio (EAA:NEAA) on broiler chickens performance from 22 to 40 days. Four hundred and eighty male broiler chicks, Cobb, were distributed in a completely randomized design, with four treatments and six replicates with 20 birds. An 16.5% CP diet was formulated, supplemented with lysine, methionine, threonine, arginine, valine, isoleucine, glycine and tryptophan, in order to attend digestible amino acids (AA) requirements. After formulation, the EAA supply in total AA (TAA) was verified and the ratio with the level of CP of the ration was calculated. It was considered as EAA: lysine, methionine + cystine, threonine, arginine, valine, tryptophan, isoleucine, leucine, phenylalanine and histidine. The other treatments were formed from glutamate supplementation in order to reach the levels of 17.5, 18.5 and 19.5% of CP. Starch, oil and inert were used in the diets to make them isoenergetic. EAA:NEAA ratios of diets with 16.5, 17.5, 18.5 and 19.5% of CP were 49:51, 46:54, 44:56 and 41:59, respectively. Evaluated parameters were: feed intake (FI), weight gain (WG) and feed conversion ratio (FCR). Data were submitted to polynomial regression analysis. Besides, Dunnett’s test was also performed, in which the diet with 19.5% of CP was considered as control. There was linear effect of CP levels on FI and FCR, and for each 1% of CP increase, it is estimated a reduction of 18.9 g in FI (y = 1510.8 – 18.882x, r² = 0.92) and an improvement of 0.034 g in WG (y = 2256.3 – 30.011x, r² = 0.94). By Dunnett’s test, it was verified that CP reduction up to 19% did not harm broilers performance. It is recommended, therefore, 19% of CP in the diet for broiler chickens from 8 to 21 days, with the EAA:NEAA of 52:48.

Key Words: glutamate, ideal protein, initial phase, requirement, supplementation

P201 Nutrient digestibility of young broiler feed fed enzyme supplemented undecorticated sunflower seed meal based diets. A. O Fafiolu*, O. O Oduguwa1, A. M Bamgbose1, A. O Fanimo1, A. V. Jegede1, and O. M. O Idowu1, 1University of Agriculture, Abeokuta, Ogun State, Nigeria, 2University of Agriculture, Abeokuta, Ogun State, Nigeria, 3University of Agriculture, Abeokuta, Ogun State, Nigeria, 4University of Agriculture, Abeokuta, Ogun State, Nigeria, 5University of Agriculture, Abeokuta, Ogun State, Nigeria.

Nutrient digestibility of starting broiler feed containing different levels of enzyme supplemented undecorticated sunflower seed meal was determined. Six hundred and forty (640) unsexed Anak 2000 day old broiler chicks were used to conduct the study. The chicks were allocated to eight dietary feed prepared in a 2x4 factorial arrangement within a randomised complete block design with twenty bird per replicate in four replication per treatment. Digestibility coefficient for dry matter, crude protein, crude fibre, ether extract and ash were determined. Dry matter and crude protein digestibility reduced significantly while crude fibre showed no definite pattern though higher inclusion of undecorticated sunflower seed meal led to reduced crude fibre digestibility. Ether extract values also reduced significantly at 75% undecorticated sunflower seed meal inclusion. Enzyme supplementation of undecorticated sunflower seed meal diets showed that the various components of proximate constituents were better utilised.

Key Words: undecorticated, digestibility, enzyme, supplementation, sunflower

P202 Effects of mannanoligosaccharides on broiler live performance. N. A. A. Barbosa*1,2, N. K. Sakomura1, M. A. Bonato1, E. O. Oviedo-Rondón3, and F. Goldflus3, 1Department of Zootecnica, UNESP, Jaboticabal, SP, Brazil, 2Department of Poultry Science, North Carolina State University, Raleigh, 3Biogirgin, Brazil.

One experiment was conducted to evaluate the effects of two mannanoligosaccharide (MOS) sources on broiler performance. 1280 Cobb male broilers were distributed in 32 floor pens with used litter in a completely randomized design with four treatments and eight replicates of 40 birds in each. The following treatments were analyzed: control, antibiotic (virginiamycin, 20 ppm), MOS-1 (ActiveMOS), and MOS-2. A corn-soybean meal basal diet with meat and bone meal and free of anticoccidial drugs was used. Birds were vaccinated against coccidiosis. Feed additives were supplemented according to treatments replacing inert material. MOS were added at 1.5, 1.0 and 0.5 kg/ton in starter, grower and finisher diets, respectively. Drinkers were cleaned only twice a week to increase microbial challenge conditions. Body weight gain (BWG), feed intake, feed conversion ratio, viability, and production efficiency factor (PEF) were evaluated from 1 to 42 days of age. Significant differences (P<0.05) among treatments were observed on BWG, feed conversion and PEF. Broilers fed diets with both MOS products had similar BWG than the ones fed diets with antibiotic. However, the BWG of these treatments were not significantly different from the control group. Dietary inclusions of MOS-1 and antibiotic promoted significant positive effects on feed conversion and PEF compared to the control group. MOS could be used as an alternative to antibiotic growth promoters for broilers. Not all commercial sources of MOS are the same.

Key Words: mannanoligosaccharides, prebiotics, growth promoters, additives, broilers
P203 Influence of dietary crude protein and metabolizable energy on growth parameters of the French guinea fowl. S. N. Nahashon*1, S. E. Aggrey2, N. Adepoju1, A. Amenyenu1, and D. Wright1, 1Tennessee State University, Nashville, 2University of Georgia, Athens.

This study was conducted to assess the influence of dietary crude protein (CP) and metabolizable energy (ME) on growth parameters of the French Guinea fowl (FGF), a meat-type variety. In a 3 x 3 factorial arrangement, 297 day-old French guinea keets were randomly assigned to experimental diets comprising 3,050, 3,100 and 3,150 ME kcal/kg diet each containing 21, 23 and 25% CP from hatch to 9 weeks of age (WOA). Using BW and feed conversion ratios (FCR) data from hatch to 9 WOA, the Gompertz-Laird, a nonlinear mathematical (NLM) function, was employed to estimate growth patterns of the FGF. Mean differences in exponential growth rate, age of maximum growth and asymptotic BW among dietary CP and ME levels were not significant. However, instantaneous growth rate and weight at inflection point were significantly higher (P<0.05) in birds on 25% CP diet than those on 21% CP diet (1.12 kg/wk and 0.79 kg vs. 1.04 kg/wk and 0.74 kg, respectively). The exponential growth rate was also higher (P<0.05) in birds fed the 3,050 ME kcal/kg diet with either 23 or 25% CP than those fed diets containing 3,050 ME kcal/kg and 21% CP. Mean FCR was higher (P<0.05) in birds fed diets containing 3,050 ME kcal/kg and either 21 or 23% CP than those in other dietary treatments. Therefore, diets containing 3,100 to 3,150 ME kcal/kg in combination with either 23 or 25% CP were utilized more efficiently by the FGF and growth parameters of birds on these diets were higher than those of other dietary treatments.

Key Words: French guinea fowl, growth parameters, Gompertz-Laird model

P204 Use of sodium chloride in Japanese laying quails diet. F. B. Petrucci1, J. G. Vargas Jr*1, F. G. P. Costa2, B. A. Scotta1, W. A. Barbosa1, J. F. V. Marin1, F. S. Pittelkow1, and T. P. Bonaparte1, 1Federal University of Espirito Santo, Alegre, ES, Brazil, 2Federal University of Paraiba, Areiaí, PB, Brazil.

The research was developed to evaluate the effect of different dietetic sodium levels on Japanese laying quails performance. Three hundred animals were used, with initial age of 120 days, in completely randomized blocks design, with six treatments, five replicates and 10 birds per experimental unit. The experimental period was 84 days, divided into four periods of 21 days. An experimental corn-soybean meal-based diet was formulated with 2,900 kcal/kg, 0.95% digestible lysine, 0.720% of digestible methionine + cystine, 2.5% of calcium, 0.35% available phosphorus and 0.05% of sodium. To the basal diet was added 0.000%, 0.025%, 0.050%, 0.075%, 0.100% and 0.125% of NaCl in substitution to inert material in order to obtain experimental diets containing 0.05%, 0.10%, 0.15%, 0.20%, 0.25% and 0.30% of sodium. Significant effects were observed for feed intake, egg production, egg mass, egg weight, feed conversion and feed weight gain. Amongst the evaluated parameters, except for egg weight, all the remainder presented quadratic effect. This is probably due to the absorption of some nutrients, as glucose and some amino acids, are sodium-dependent. That is, birds submitted to the diets that did not had enough sodium presented smaller nutrients absorption. Counterbalancing, sodium excess might have caused an electrolytic unbalance in the animal body, due to the sodium excess in the plasma, rendering that part of the nutrients and energy that would be used in the production, were switched to the restoration of the normal physiologic condition. Therefore, by obtained results, it can be concluded that the level of 0.209% of sodium in the diet of Japanese laying quails is enough to guarantee maxim productive efficiency.

Key Words: poultry nutrition, Japanese quail, sodium chloride, egg mass, performance

P205 Supplementation of dietary hydrolyzed yeast on broiler chicks. R. Barbalho*2, L. Araujo1, C. Araujo1, A. Cozo1, L. C. G. S. Barbosa1, and M. T. Kidd1, 1Mississippi State University, Mississippi State, 2I. C. C., Sao Paulo, Brazil.

Many broiler companies electing not to use certain growth promoters have undergone testing of feed additives in search of efficacious replacement effects. The objective of this study was to evaluate hydrolyzed yeast from nucleotides on growth performance of broilers supplemented with different dietary inclusion levels from 1 to 14 d of age. A total of five hundred seventy six Ross 708 chicks were allotted to 6 experimental treatments with 8 replications (12 broilers per pen). Birds were randomly distributed in following treatments: 0, 2, 4, 6, 8, and 10 kg hydrolyzed yeast/ton of feed. The hydrolyzed yeast was added to the test diet in place of an inert filler. Starter diets were fed in crumbled form and chicks were allowed access feed and water ad libitum. All diets were based on corn, soybean meal, and poultry fat, and were formulated to achieve practical nutrient levels (following Guide Recommendations for Ross x Ross 708 broilers). Mortality did not differ among treatments. Chicks fed 10 kg hydrolyzed yeast had improved (P < 0.05) BW, BW gain, and feed conversion over birds fed all other treatments. These results indicate efficacy of hydrolyzed yeast in the starter period for live performance measurements given that birds consume 10 kg/ton.

Key Words: nucleotides, broiler chick, yeast

P206 Use of sodium and potassium carbonate for Japanese quails fed with diets containing 21% of crude protein. B. A. Scotta1, J. G. Vargas Jr*1, F. G. P. Costa2, F. B. Petrucci1, W. A. Barbosa1, F. S. Pittelkow1, J. F. V. Marin1, and L. F. Demuner1, 1Federal University of Espirito Santo, Alegre, ES, Brazil, 2Federal University of Paraiba, Areiaí, PB, Brazil.

An experiment was carried out aiming to evaluate the performance of Japanese laying quail. Birds were fed with rations containing 21% of CP and three different electrolytic balance (200, 275 and 350 mEq / ration kg) in two forms of attaining electrolytic balance increase (K2CO3 and K2CO3 + Na2CO3). Two hundred and forty birds were assigned to a completely randomized design, in a factorial arrangement 3 x 2, with four replicates and 10 birds per experimental unit. The experimental period lasted 84 days, divided into four periods of 21 days, in which posture rate (%), egg weight (g), egg mass (egg g/quail/day), feed intake (g/quail/day) and feed conversion (g/g) were evaluated. Amongst the evaluated parameters, no significant effect was observed for productive parameters between the different electrolytic balances. However, birds fed with diets containing K2CO3 had better eggs mass in comparison to those fed with the addition of K2CO3 + Na2CO3. At the 21% CP level, the Japanese quails presented active renal function in order to keep nitrogen excretion in normal level, which made the cells maintenance of the osmotic balance without adding any sodium. If there were
an excessive kidneys function, the sodium, the electrolyte present in greater amounts in the extracellular liquid, would be lost and, it would be necessary the addition of the sodium in the feeding and thus, there was no need of extra energy for the renal excretion mechanism. By the obtained results, it can be concluded that in diets with 21% CP, the best electrolytic balance is of 200 mEq/kg using K2CO3.

Key Words: potassium carbonate, sodium and potassium carbonate, Japanese quail, performance, crude protein

P207 Use of sodium and potassium carbonate in diets for Japanese quails fed with rations containing 24% of crude protein. B. A. Scotta1, J. G. Vargas Jr.*1, F. G. P. Costa1, F. B. Petrucci1, W. A. Barbosa1, J. F. V. Marin1, F. S. Pittelkow1, and D. V. G. Vieira1, 1Federal University Espirito Santo, Alegre, ES, Brazil, 2Federal University, Areias, PB, Brazil.

An experiment was conducted aiming to evaluate the effect of the electrolytic balance, obtained by using different ions sources on Japanese quail performance. Birds were fed with diets containing 24% of crude protein, three different electrolytic balance (200, 275 and 350 mEq/kg of ration) in two forms of increasing electrolytic balance (K2CO3 and K2CO3 + Na2CO3). Two hundred and forty Japanese laying quails were used, with initial age of 120 days, distributed in a factorial arrangement 3 x 2, with four replicates and 10 birds per experimental unit. The experimental period lasted 84 days, divided into four periods of 21 days, in which posture rate (%), egg weight (g), egg mass / chicken day, feed intake (g / chicken / day) and feed conversion (g / g) were evaluated. Amongst the evaluated parameters, significant differences between the different studied electrolytic balances were not observed. However, it was observed that birds fed with diets containing joint addition of K2CO3 + Na2CO3 for attainment of the electrolytic balance presented better egg weight. This probably occurred due to the crude protein level of diet provided a nitrogen excess for the birds, leading them to excrete the excess, and thus promoting a greater renal activity. This may have caused osmotic unbalance of cells, and decreased extracellular electrolyte level, rendering necessary the sodium addition, since this is the ion present in greater proportion in the extracellular liquid. With the addition of only K2CO3, there was not enough sodium for the birds to excrete the excess, and thus promoting a greater renal activity. However, birds provided fish oil yielded 11.23% less abdominal fat than birds not provided any oil (P < 0.05). This indicates that supplementation of oil source can impact carcass characteristics in broilers.

Key Words: fish oil, broiler, carcass

P208 Impact of post hatch administration of oil sources to broiler chicks on subsequent performance. L. Araujo, C. Araujo, A. Corzo, L. C. G. S. Barbosa*, and M. T. Kidd, Mississippi State University, Mississippi State.

Per os administration of oil sources to chicks has received little attention. The present study was designed to investigate the supplementation of oil sources to chicks post hatch (after transportation from the hatchery (1 h) and prior to placement) on subsequent performance and processing traits. Four hundred twenty straight run broiler were allocated to 35 pens (12 birds per pen). Five per os treatments consisted of: no oil source; corn oil; soybean oil; fish oil, and conjugated linoleic acid (CLA). The oil was provided in a 1 mL syringe and all birds received oil at an iso caloric level (4.23 kcal ME). Each pen contained a tube feeder, a drinker line, and built up pine shavings. From 1 to 42 d of age birds were fed common diets in crumble/pellet form that met or exceeded Ross nutrient recommendations (1 to 14, 15 to 26, 27 to 35, and 36 to 41 d). All diets were primarily composed of corn, soybean meal, and poultry fat. Live performance was evaluated in the starter period (7 and 14 d) and overall. At 41 d of age, three broilers of each sex were weighed separately and processed to determine carcass yields. Birds that were provided CLA had lower (P < 0.05) BW at 7d of age than all other treatments. Regarding processing, supplementation of corn oil resulted in lower tender yield (P < 0.05) than broilers provided other oil sources. However, birds provided fish oil yielded 6.28% more breast meat and 11.23% less abdominal fat than birds not provided any oil (P < 0.05). This research indicates that supplementation of oil source can impact carcass characteristics in broilers.

Key Words: mannanoligosaccharide, yeast culture, energy available, broiler chickens

P209 Effects of the addition of a mixture of cell wall components and a yeast culture on the energy released from the diet of broiler chickens. S. Gomez*1,2, M. L. Angeles1, M. C. Mojica3, and J. Buenrostro3, 1CENIDyFA-MA-INIFAP, Ajuchitlan, Qro, Mexico, 2FES-Cuautitlan-UNAM, Ajuchitlan, Qro, Mexico, 3SynBios SA de CV, Queretaro, Qro, Mexico, 4Vi-COR, Mason City, IA.

Three balance trials and a growth performance experiment were done to evaluate the energy released from low energy diets added with mannanoligosaccharide plus a yeast culture from Saccharomyces cerevisiae (MOS+CSc) in broiler chickens. In the balance trials, 216 starter from 8 to 21 days, 72 grower from 22 to 35 days and 72 finisher from 36 to 49 days of age B308 broiler chicken allocated in metabolic crates were use. Birds were assigned to four dietary treatments in a factorial arrangement of 2 energy levels (Normal and Low: 3000/2900, 3100/3000 and 3200/3100 kcal of ME/kg of feed in the starter, grower and finisher phases) and 2 levels of MOS+CSc (0 and 1 kg/ton). There were 18 replications per treatment and results were subjected to analysis of variance. In the growth performance experiment, 1170 male B308 broiler chickens were assigned to 5 dietary treatments: T1= Normal energy diet with 3000, 3100 and 3200 kcal of ME/kg of feed in the starter, grower and finisher phases; T2= 2% less energy than T1 in the starter and 4% less energy in the grower-finisher diets; T3= 3% less energy than T1 in the starter and 6% less energy in the grower-finisher diets; T4 and T5 as T2 and T3 plus 1 kg of MOS+CSc per ton of feed. There were 9 replications per treatment and results were subjected to analysis of variance. The addition of MOS+CSc to the Low energy diets increased the energy released in 58, 82 and 106 calories in the starter, grower and finisher balance trials but no statistic differences were observed. In the performance experiment, the ADG was similar for T1, T2, T4 and T5 and lower for T3 (P < 0.05). The feed conversion ratio was similar for T1, T2 and T3 plus 1 kg of MOS+CSc per ton of feed. There were 9 replications per treatment and results were subjected to analysis of variance. The addition of MOS+CSc to a low energy diet can increase the dietary energy available up to 60 kcal in the starter and from 128 to 192 kcal in the grower and finisher diets.
**P210 Early nutrition experiments in broilers chickens.** C. Araujo*, L. Araujo, C. D. Zumwalt, A. Corzo, L. C. G. S. Barbosa, and M. T. Kidd, Mississippi State University, Mississippi State.

Improvements in genetic selection of commercial broilers have deemed early nutrition as a very important aspect of production. Therefore, availability of feed and feed type after hatch has found advantages to reach the best economic return. Two experiments were conducted to evaluate performance and carcass characteristics of broilers fed at d 1. In experiment 1, one thousand eight hundred Ross 708 chicks were sexed and placed into 36 chick trays. Early treatments represented crumbled broiler starter feed and was administered in the center of the trays on paper. Chicks received 3 treatments (12 replications/treatment of 50 chicks each): no hatchery supplement; hatchery feed representing 454 g of a starter diet; or hatchery feed representing 454 g of a starter diet plus 0.125% of yeast. Chicks were allowed to receive treatments 5 h before placement. In experiment 2, one thousand four hundred Ross 708 chicks were randomly distributed across 7 treatments representing a control (no feed) or six treatments of 454 g starter feed in a hatchery tray (50 chicks per tray). The starter feed contained: 0.5 mL of water; 0.5 mL water plus 0.22 mg glycine-zinc (GlyZn); 0.5 mL water plus 0.24 mg glycine-manganese (GlyMn); 0.5 mL water plus 0.20 mg vitamin complex, and one treatment with all nutrients before described. Chicks were in trays 5 h before placement. Water and feed were provided ad libitum, and performance and carcass characteristics were measured in both experiments. No differences occurred in experiment 1. In experiment 2, birds that received vitamins and GlyZn solutions showed better BW at 49 d than birds fed the control group (P < 0.05). Birds that received water plus glycine-zinc had improved (P < 0.05) feed conversion at 49 d, but GlyZn alone resulted in better carcass and breast meat yield than birds in the control group (P < 0.05). These results point to possible improvements in broiler performance as affected by early feeding.

**Key Words:** hatchery feeding, chick, glycine, zinc

**P211 Assessment of manganese needs of mature Ross hens.** L. Araujo*, C. Araujo, C. D. McDaniel, H. M. Parker, S. Hubbard, S. L. Branton and M. T. Kidd, 1Mississippi State University, Mississippi State, 2United States Department of Agriculture, Mississippi State, MS.

Recent studies at Mississippi State University Poultry Research Unit have demonstrated the importance of Mn supplementation for breeders and heightened effects of progeny. This experiment was conducted to evaluate supplementation levels of Mn to mature breeders from 52 to 65 wk to better assess its need for good hen production. One hundred twenty Ross 708 hens received a control diet (vitamin and mineral premix devoid of Mn) or the control diet supplemented with inorganic Mn in the form of Mn sulfate (30mg/kg; 60 mg/kg; 90 mg/kg; and 120 mg/kg). All five dietary treatments were supplied in mash form. Breeders were housed in a floor pen facility with 40 pens (8 replications/treatment). Each pen was equipped with 1 feeder, nipple drinkers, and 1 nest. Each pen contained 3 females which were inseminated before eggs were collected. A total of five hundred eggs (100 eggs per treatment) were obtained and set at 61 wk of age. Egg production, specific gravity, fertility (inertia, hatchability, mortality, pip, bacteria, culls), and chick quality (dehydration, small navel, large navel, open navel condition, wet chicks, wicks, dried yolks, and red hocks) characteristics were measured. Linear or quadratic trends were not observed for any parameter. There were no differences in egg production. However, feeding broiler breeders 120 mg inorganic supplemental Mn/kg improved egg specific gravity, fertility, and hatchability (P < 0.05). Breeders receiving 30 mg inorganic supplemental Mn/kg resulted in biggest incidence of wet chicks (P < 0.05). Other chick quality characteristics were not influenced by dietary treatments.

**Key Words:** broiler breeder, manganese, hatchability, fertility

**P212 Determination of minimum available phosphorus level needed to maximize growth performance in straight-run broilers through 28 days of age.** S. K. Pohl*, J. R. Prukop, L. A. Oden, A. E Klein, and J. T. Lee, Department of Poultry Science, AgriLife Research, Texas A&M University, College Station.

Phosphorus is a vital nutrient in broiler diets due to effects in bone mineralization; however, due to the eutrophic effects of excess dietary phosphorus excretion in waste as well as the impending cost of phosphorus ingredients used in diet formulation, it is becoming increasingly important to limit excessive use of phosphorus. This experiment was conducted in order to determine the minimum level of available phosphorus required to maximize growth of straight run broilers through 28 days of age when reared in industry type floor pens or experimental type battery pens. Experimental design consisted of six dietary treatments including calculated available phosphorus levels of 0.30%, 0.35%, 0.40%, 0.45%, 0.50%, and 0.55% in the starter diet. On day 14, all treatments were switched to a grower diet with a 9% reduced available phosphorus concentration as compared to each treatment’s initial starter diet. Each treatment consisted of five replicates of 40 chicks in the industry type floor pens and 10 chicks in each experimental type battery pen at day of placement. Floor pen birds were raised on fresh pine shavings and all chicks were administered fresh water and appropriate feed treatment ad libitum. At the conclusion of the starter period, the minimum available phosphorus level needed to maximize broiler growth in floor pens was 0.45% however; the minimum level of available phosphorus needed to maximize growth in battery pens was 0.40%. At the conclusion of the study on day 28, floor reared broilers fed the initial available phosphorus concentration of 0.40% yielded similar performance characteristics compared to increased levels. On day 28, broilers reared in battery pens fed the starter diet with an initial concentration of 0.35% yielded similar body weights as those fed increased levels. These data indicate that the minimum available phosphorus concentration needed to maximize growth varies according to rearing environment.

**Key Words:** broiler, body weight, phosphorus, feed conversion, rearing environment

**P213 The effect of exogenous phytase on dietary energy and nutrient digestibility for laying hens.** V. Pirgozliev*, T. Acamovic1, 2ISAC, Ayr, Scotland, United Kingdom, 2AB Vista, Marlborough, England, United Kingdom.

There is far less data available describing the effects of microbial phytases in the diets of laying hens compared with broilers. The aim of this experiment was to determine the effect of relatively low doses of Quantum™ phytase on dietary apparent metabolisable energy (AME) and nutrient digestibility when fed to layers. A total of 90 ISA Brown hens were fed three mash maize-soybean meal-based diets containing...
Boneless chicken breast fillets (pectoralis major) and tenderloins (pectoralis minor) are common poultry products in retail markets and are used extensively by restaurants and food service. Texture quality of these products could be impacted by poultry processing methods and parameters. Effects of chilling methods on fillets are available in published literature; however, there is a lack of published information of chilling methods effects on tenders. The objective of this study was to evaluate the effect of carcass chilling methods, water immersion chilling (IC) and air chilling (AC), on sensory texture descriptive profiles, Warner-Bratzler (WB) shear and cook yield of broiler breast tenders deboned at 4h postmortem. Ready-to-cook carcasses (42 days of age) were hot-boned as a pre-chill control, or chilled either by IC (0.30°C, 50 min) or by AC (0.70°C, 150 min). The chilled tenders were removed from the bone at 4h postmortem. Tenders were cooked to an endpoint temperature of 78-80°C. The texture qualities were measured by trained sensory panelists using 0-15 point universal intensity scales and by a TA-XT Plus Texture Analyzer fitted with a Warner-Bratzler shear blade. Our study shows that the average intensity scores for the 12 sensory texture attributes ranged from 1.5 to 5.9, the WB shear averages ranged from 20 to 31 Newton, and the average cook yield was 87%. No differences were found in cook yield between the hot-boned and the chilled samples. The average intensity scores of the texture attributes, cohesiveness, hardness, cohesiveness of mass, rate of breakdown and chewiness, and the average WB shear force values were significantly higher in the hot-boned samples than either of the chilled samples. However, there were no significant differences in the sensory texture profiles, WB shear and cook yield between the immersion-chilled and air-chilled tenders. These results demonstrate that either of IC and AC methods can be used to reduce broiler carcass temperature without losses of chicken breast tender texture quality and cook yield.

Key Words: chicken, tenderloin, chilling method, texture, cook yield

2.2 g/kg available P (negative control, NC), supplemented with 0, 125 or 250 FTU (phytase units/kg feed). The birds received the experimental diets from 35 to 39 weeks of age, and each diet was replicated ten times in a randomised block design. During the last 24h of the study the excreta were collected and prepared for further analysis. No differences (P>0.05) in dietary AME, N retention, dry matter (DM) and mineral digestibility were found between the NC and NC+125 FTU. However, the diet supplemented with 250 FTU had higher (P<0.05) AME (13.51 vs 12.83 MJ/kg DM) and DMD (0.758 vs 0.720) than the NC. The digestibility coefficients for dietary Mg, P, Zn and K were 29.9, 31.8, 46 and 71.5%, respectively, higher (P<0.05) for the NC+250 FTU compared to the NC. Dietary feed intake was not (P>0.05) influenced by the phytase supplementation. These results indicate that even relatively low activities of Quantum® phytase can improve the intake of available nutrients in maize-soybean meal-based mash diets when fed to layers. It also supports the view that the use of dietary phytases is an efficacious method of reducing the pollution.

Key Words: phytase, layers, AME, nutrients, digestibility

P214 Comparison of the characteristics of black skin broilers with commercial broilers and dark cornish. R. K. Bramwell1*, J. R. Moyle1, D. E. Yoho1, R. S. Harper1, A. D. Swaffar1, and T. Whiting2.

In the US, Commercial Broiler Production primarily consists of white feathered broilers with the ‘traditional’ light colored meat. However, in other parts of the world where markets vary and traditions linger, colored feathered birds and in some cases dark meat birds are preferred. The Japanese Silkie is a breed with black heavily pigmented skin and heavily pigmented meat but is typically very small (< 1.3 kg). This black skin bird is preferred in many parts of the Asian world as not only a delicacy, but a preferred meat. The black skin characteristics were bred into a commercial broiler type bird that expresses the hyper-melanistic characteristics and can obtain a body weight of more than 2.5 kg at market age. This study was designed to evaluate the broiler characteristics of the ‘black skin broiler (BS)’ as compared to the Cobb 500 (CS) and Cobb 700 (C7) commercial broilers, and a standard size Dark Cornish (DC). All birds were hatched and raised from day-old using common broiler management guidelines in the same facility. The C5 and C7 birds were grown to a six-week market age while the BS and DC birds were grown to a 10 week market age. Final body weight and feed conversion were obtained at the conclusion of the growth period with all birds reaching the market age on the same date. Birds were processed to determine percent yield for WOG, fillets, tenders, wings, and legs quarters. Product obtained from the C5 and BS birds were evaluated using a controlled sensory panel. As expected, results showed that the BS and DC birds had lower body weight, poorer feed conversion and smaller part weights than both C birds. However, leg quarters and wings as a percent of WOG were significantly higher in both the BS and DC birds. Sensory panel results showed the BS product scored lower than the C5 product for all criteria evaluated. However, sensory data was strongly influenced by the inability to completely disguise the meat color.

Key Words: black skin broilers, meat quality
ics through utility costs. While process modifications involving recycle streams offer the opportunity to reduce water consumption there is a direct influence on process water quality. Any proposed water reduction strategy requires thorough analysis prior to implementation to avoid undesirable decreases in water quality.

Key Words: bacteria, contamination, reduction, simulation, water quality

P217  
Comparison of neck skin versus whole carcass rinse for incidence of Salmonella and level of E. coli recovered from broiler carcasses.  
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In the U.S. individual broiler carcasses are rinsed with 400 mL of 1% buffered peptone water (BPW) for Salmonella incidence detection, while the European Union (EU) uses a 25 g composited neck skin sample from three carcasses. Therefore, the objectives of the study were to obtain carcasses from a commercial U.S. processing facility and compare the U.S. and E.U. sampling methods for Salmonella prevelance as well as evaluate levels of E. coli. Two replications of 30 broiler carcasses each were obtained from a commercial plant just prior to the inside-outside carcass washer. The neck skin was aseptically removed and bagged separately from the carcass and transported to the laboratory for microbiological analysis. Neck skin (8.3 g) was aseptically weighed, added to 83 mL BPW and stomached for 30 sec. The corresponding carcass was bagged along with 400 mL BPW and shaken for 1 min; 30 mL of the 400 mL of carcass rinse were removed and added to an additional 30 mL of BPW. Aliquots were then removed from each sample and plated onto Petrifilm® for E. coli/colliform enumeration while the entire neck skin and carcass rinsates were incubated for 24 h at 37 C. After incubation, standard cultural procedures for Salmonella were used for both samples. In both repetitions, the E. coli counts were significantly greater (P<0.05) for the carcass rinse procedure (log10 2.9 cfu/mL) compared to the stomached neck skin (log10 1.9 cfu/mL). However, for Salmonella incidence there was no significant (P>0.05) difference between the two sampling methods. In rep 1, neck skin detected Salmonella from 17/30 carcasses and 19/30 carcass rinsates. In Rep 2, the neck skin and carcass rinse were both positive for 13/30 carcasses. Additional research is needed to sample a larger number of carcasses and at various sites in the processing plant to determine if one sampling method has an advantage over the other in regards to detecting Salmonella.

Key Words: whole carcass rinse, neck skin, Salmonella, E. coli, poultry carcass

P218  
Effect of stomaching on numbers of bacteria recovered from chicken skin.  
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Compared to rinsing, stomaching releases only a few more bacteria from a skin sample, but successive rinses continue to remove almost as many bacteria as the first rinse. One hypothesis to explain this observation is that relatively violent treatment of skin generates smaller pieces of skin thus increasing surface area and effectively sequestering bacteria so that fewer are suspended in the rinsate. An experiment was conducted to determine whether inoculated marker bacteria disappear from rinse liquid as skin pieces are stomached and naturally occurring bacteria are released. In each of 4 replications, 5 pre-chill broiler carcasses were collected from a commercial processing plant. Two 5 g pieces (n=40) of breast skin were removed from each carcass and placed in a stomacher bag. Thirty mL of 0.85% saline solution containing 10⁴ Salmonella Typhimurium per mL was added to each sample. Skin samples were hand massaged for 30 s to mix the inoculum, after which a 1 mL aliquot was removed for enumeration bacteria. A similar sample was taken after 4 min of vigorous stomaching of the skin sample. Bacterial counts recovered from the 30 second hand massage were 4.3, 2.7, 2.6, and 3.7 log10 cfu/mL of rinsate for APC, coliforms, E. coli, and Salmonella, respectively. After stomaching, counts were 4.3, 2.9, 2.8, and 3.8, respectively. There was no difference in APC, but mean coliform and E. coli counts were significantly higher (P<0.05) after stomaching. Numbers of inoculated Salmonella did not decrease. Breaking up skin into smaller pieces by stomaching did not reduce the number of inoculated bacteria suspended in the rinsate.

Key Words: Salmonella, E. coli, rinsing, skin, broiler

P219  
Breast meat quality characteristics of spent breeder hens.  

Breeder hens are large birds, weighting 3.0 to 4.0kg, with broiler-like conformation, with high amount of leg and breast meats, although it presents large fat deposition, both subcutaneous and abdominal. This study aimed to evaluate the characteristics of spent breeder hens breast meat quality collected in a commercial processing plant in Itapetininga (SP) city. 120 debone breast meat (Pectoralis major), were collected, shared at six collect with 20 samples each. pH and R value analysis in all samples were performed at 1.5 (zero time) and 4 hours post mortem. Samples were sent to the laboratory of FMVZ/UNESP, where the following meat quality analysis were carried out 24 hours post mortem: pH, R value, color, drip loss, water retention capacity, water holding capacity, emulsifying capacity, cooking loss, shear force and sensorial analysis. Average values for pH, R and L* value were 5.70, 1.40 and 50.11, respectively. Drip loss, emulsifying capacity and water holding capacity were 2.00%, 70.22mg/0.5g e 57.75%, respectively. For water retention capacity, cooking loss and shear force the mean values were 76.67, 17.92% and 4.94kgf/cm² respectively. When the sensory analysis was performed, the hens meat presented lower tenderness intensity (6.9) and juiciness (3.4), and more elastic, rubber and difficult to swallow than broiler meat. Thus, the spent hen meat presented adequate technological characteristics to possibly be used as meat for further-processed products. However, it presented lower conditions related to some sensorial attributes like tenderness and juiciness compared to broiler breast meat.

Key Words: broiler chicken, meat quality, sensory analisis, spent birds, tenderness

The preference for well-pigmented poultry products in some markets around the world makes producers to add colorants into broiler rations as a way of improving attractiveness of the final products. *R. gelatinosus* biomass is a natural, pathogens-free source of red oxycarotenoids produced in poultry abattoir wastewater. This experiment was conducted to evaluate the effects of diets containing different concentrations of *R. gelatinosus* biomass on broilers cuts color. Cobb male broilers’ rearing was in floor pens, with water and diets supply on an ad libitum basis. Broilers corn-soybean based basal diets were supplied as follows: starter ration (1 to 21 d), grower ration (22 to 35 d) and finisher ration supplemented with the biomass at 0 (control), 400 and 800 ppm (36 to 44 d), as the dietary treatments. Each treatment was randomly allocated to 4 replicate pens with 10 birds each. Birds and diets were weighed at the beginning and at the end of finisher period for performance analysis. Two birds of each pen were killed according to Brazilian legal procedures and cuts of breast and thigh were prepared with and without skin. Color attributes were measured colorimetrically with a MiniScan XE Plus (Hunter Lab). Treatments were subjected to ANOVA and performance means were compared by Duncan’s test at 5% significance. The relationship between biomass concentration in the feed and each color attribute was determined by regression analysis by orthogonal polynomials. Dietary treatments caused significant linear increases (P <0.05) of redness at breast and thigh skin and at breast and thigh meat with coefficients of correlation of 0.61, 0.61, 0.68 and 0.69, respectively, and no significant changes in lightness and yellowness at none of the cuts analyzed (P >0.05). Broilers’ performance did not change significantly (P >0.05) with the biomass supplementation. Results show that the biomass deposits into broilers’ meat and skin, increasing redness of broiler cuts without causing deleterious effects on birds’ performance.

Key Words: breast, thigh, skin, meat, *Rubrivivax gelatinosus*


In many consumer markets, egg yolk color is an important quality attribute and defines purchasing decision. That makes producers to add extra xanthophylls in hens’ rations as a way of improving egg attractiveness. Following the present tendency on the use of natural products in human and animal nutrition, an experiment was conducted to evaluate the use of *R. gelatinosus* oxycarotenoids as colorant to egg yolks. Thirty six Dekalbe laying hens at 19 wks of age were individually housed in wire cages equipped with feeders and drinkers to receive ad libitum the experimental diets that consisted of red *R. gelatinosus* biomass (pathogens-free) at 0 (control), 1,500 and 3,000 ppm added into a corn-soybean based basal diet nutritionally balanced to laying hens. Treatments contained 3 replicates with 4 hens each and were supplied for 30 days, under a constant lighting program of 16 h of light/day. Yolk color attributes were objectively determined with a MiniScan XE Plus (HunterLab) during the 5 last days of the experiment. Data for performance analysis were recorded at the beginning and at the end of the experiment. Data on yolk colors and productive parameters were subjected to ANOVA and significant differences among treatment means were determined by Duncan’s Test at 5% probability. The administration of increasing levels of the biomass caused a significant darkening of yolks (P = 0.0021) and a significant increase in redness (P <0.0001), showing the effective deposition of the red biomass oxycarotenoids in yolks. As yellowness did not increase significantly (P = 0.0844), a new orange color arose due to the increase in redness. Feed intake increased significantly with the increases in biomass addition (P <0.0001) probably due to an improvement in the feeds color and/or flavor and so did egg production (P = 0.0175). Feed conversion and egg weight did not change significantly (P = 0.6199 and 0.9351, respectively). *R. gelatinosus* increased yolks lightness and redness, contributing to an improvement in yolks color.

Key Words: yolk color, *Rubrivivax gelatinosus*, biomass, oxycarotenoids, redness


Consumers are wary about the impact food fats have on their health. So, some studies aim at improving the polyunsaturated fatty acids (PUFA) contents in broilers meat through dietary supplementation. However, higher contents of PUFA expose broilers meat to lipid oxidation. This study was conducted to evaluate the characteristics of meat lipid fraction of broilers fed soybean and linseed oil and the effect of dietary vitamin E on meat lipid oxidation. A total of 360 Cobb (males and females) broilers were raised until 49 d of age on a corn-soybean meal-based diet containing 6.5% vegetal oil. The experiment was a 3x3x2 factorial with three combinations soybean:linseed oil (6:1, 0:4, 5:4:1 and 3:4:3, 1%); three concentrations of vitamin E (0, 200 and 400 ppm) and 2 sexes. After slaughtering, total lipids (TL), fatty acids profile (FAP) and cholesterol content (CC) were determined in breast and thigh meat. Thiobarbituric acid (TBA) reaction was used to evaluate lipid oxidation in samples of thigh maintained at -25°C for 45 days. The composition of the dietary vegetal oil did not influence any of the meat traits evaluated (P >0.05). TL of meat was not altered by sex (P >0.05) whilst CC was significantly higher in male than in female meat (P <0.05). However, male broilers meat had significant lower contents of saturated fatty acids (SFA) and higher contents of PUFA than female meat (P <0.05) but this difference in FAP was not significantly associated to lipid oxidation. The administration of vitamin E at 200 or 400 ppm significantly decreased meat TBA (P <0.05), with no difference on lipid oxidation up to 200 ppm. The use of linseed as linolenic acid source in broilers feed was not able to influence the fatty acids composition of meat at the concentrations supplied. Male broilers meat had higher CC and PUFA and lower contents of SFA than female broilers meat. Dietary supplementation of vitamin E at 200 ppm was enough to prevent meat lipid oxidation.

Key Words: vitamin E, lipid oxidation, broilers meat, fatty acid, cholesterol


There is almost a common sense among food consumers about the beneficial effects of polyunsaturated fatty acids (PUFA), particularly...
omega-3 (n-3) on their cardiovascular system. Because of that, some studies have been trying to demonstrate the benefits of the inclusion of n-3 PUFA sources such as linseed oil directly in foods or in feeds, as in broilers diets, aiming at their increase in meat. This research investigated the effects caused on broilers performance due to the substitution of soybean oil for linseed oil in diets. Cobb-one-day chicks (192) were raised in floor pens until 42 d of age with a corn-soybean meal-based diet containing 6.5% soybean or linseed oil at an ad libitum basis. The experiment was a 2x2 factorial, with two sexes and two dietary oil sources as variables. Data for performance analyses were recorded at 21 and 42 d of rearing. Additionally, the effect of the dietary concentration of linseed oil on broilers’ performance response was evaluated. Test birds were vaccinated against Newcastle virus at 7 and 21 d of age. At slaughter, blood samples were collected for antibody titration by ELISA. Feed consumption and weight gain were significantly lower (P <0.05) for birds that received linseed, probably due to the presence of linatin, an antimutagenic factor that forms complexes with pyridoxine. The main symptom of pyridoxine deficiency is the growth delay due to decrease of hunger. Immunological response also was injured by dietary linseed. While soybean oil is rich in linolic acid, the precursor of leucotriens involved in immune system, linseed oil contains substantial amounts of linolenic acid, precursor of other n-3 PUFA's. Considering that the metabolism of these fatty acids require the same enzymes, an excess of linolenic acid may be harmful for the formation of important compounds involved in the immunological mechanism. In conclusion, it is necessary to make an appropriate balance of vegetable oils in broilers feed in order to avoid damages in performance.

Key Words: polyunsaturated fatty acid, cholesteral, performance, broiler meat, immune response

P224 Effect of irradiation on the microbiological quality of chicken breast stored for different periods. K. F. G. Cardoso, A. A. Mendes*, V. L. M. Rall, I. C. L. A. Paz, and C. M. Komiyama, Universidade Estadual Paulista, Botucatu, SP, Brazil.

The effect of irradiation on the reduction and/or destruction of microorganisms present in chicken breast stored under refrigeration and freezing was studied. Forty chicken breast filets were obtained from a slaughterhouse inspected by the SIF. The samples were placed in vacuum plastic packages and then they were refrigerated or submitted to slow freezing. The samples were irradiated with a dose of 3 kGy and then stored in cold room (4°C) for 21 days or freezer (-18°C) for 90 days, according to treatment. Microbiological analyses were performed to determine the number of mesophilic aerobic microorganisms, or optional anaerobic, to treatment. Microbiological analyses were performed to determine the number of thermotolerant coliforms and detection of the presence of Salmonella. The samples placed in modified atmosphere showed a better microbiological quality than the vacuum packed ones.

Key Words: modified atmosphere, chicken breast, microbiology, shelf life, Salmonella

P226 Comparison between the conventional microbiological method and the PCR method in the detection of Salmonella in naturally contaminated cuts of chicken. K. F. G. Cardoso, V. L. M. Rall, A. A. Mendes*, J. P. Araujo Jr, and J. M. G. Candeias, Universidade Estadual Paulista, Botucatu, SP, Brazil.

Demand for tests for detection of Salmonella in poultry has increased, especially for those most rapid, efficient and economical, due the requirements of quality control and market pressures, which appears eager for volume production and quality. The purpose of this study was to compare the conventional method and PCR to Salmonella detection in retailed poultry naturally contaminated. The data were positive for Salmonella in the samples using PCR and conventional method were analyzed by test Mac Nemar with a significance level of 5%. We collected 50 samples, from nine different establishments in Botucatu city, Sao Paulo, from August 2007 to February 2008. Only 4 (8%) presented this pathogen using the traditional method and 23 (46%) by PCR, a statistically significant difference (S = 14.0 p = 0.0002). The results show the speed and high sensitivity are great advantages, been an important tool for the food industry. Then, it can be used in all productive chain, including the final product, ensuring the industry and the consumer product quality.

Key Words: Salmonella, PCR, microbiology, chicken, quality

P227 Evaluation of occurrence and quality characteristics of PSE meat in broiler chickens. R. G. Garcia*1, A. M. A. Gabriel1, J. D. Gra- ciano1, F. R. Caldar1, F. M. J. Vargas1, L. W. Freitas1, A. W. Schwingel1, C. M. Komiyama2, and R. M. Farias1, 1UFGD - Universidade Federal da Grande Dourados; FCA - Faculdade de Ciências Agrárias, Dourados, Mato Grosso do Sul, Brazil, 2FMVZ/UNESP - Faculdade de Medicina Veterinária e Zootecnia de Botucatu-SP, Botucatu, São Paulo, Brazil.

It was undertaken a visit in commercial slaughter of Mato Grosso do Sul state, aiming to evaluate the occurrence of pale breast meat in broiler chickens, and was chosen a slaughter located in Dourados city. Incidence
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of pale meats was realized using L* value (lightness), a* (redness) and b* (yellow) parameters in commercial plant of slaughter. The colorimeter used was Minolta CR-300, portable equipment and it was considered pale meat when samples presented L* value equal or higher 49. It was evaluated 600 samples with 50 normal-colour and 50 pale-colour were send to the FCA/UFGD Laboratory and it was evaluated the remaining meat quality parameters (drip loss, water retention, cocking loss, texture and sensorial parameters). For breast fillets of broilers with pale coloration, the initial pH values was 6,54 and final pH values was 6,50, while normal colorations ones presented initial pH of 5,67 and final pH of 5,89. It was observed difference (p<.05) between pale and normal fillets for pH, L* value, redness, water retention and cocking loss. No difference was observed difference (p>.05) between pale and normal fillets for texture and sensorial parameters. This research revealed that the occurrence of pale meat in broiler breast was 10,20%.

Key Words: broiler meat, meat color, pH, water retention capacity, PSE meat


The pre-slaughter of broiler, which extends from the withdrawal of the diet in the farm to slaughter, is probably one of the stages of the production chain that exerts greater influence on the qualitative and quantitative indices of the proceeds from slaughterhouse. The objective was to evaluate the effect of different periods of fasting pre-slaughter (4, 8, 13 and 17 hours) on the attributes of quality of breast meat of broilers type Grille and microbiology of the gastrointestinal tract. 40 birds were used (females), Ross, randomly distributed in the treatments (10 birds / treatment). In 35 days the birds were slaughtered and the variables were analyzed: water holding capacity, loss of exudate, loss of water by cooking the brisket and the presence of microorganisms in the gastrointestinal tract. The results showed that the time of fasting pre-slaughter had no significant effect (P> 0.05) on any of the variables. The duration of fasting had no influence on the attributes of quality of breast meat of broilers type grill and microbiology of the gastrointestinal tract.

Key Words: water holding capacity, griller broiler, loss of exudate, loss by cooking, food restriction