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Effect of Protein and Amino Acid Levels on Bone Formation in Diets Varying in Calcium Content¹

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The effect of different dietary levels of amino acids, calcium and phosphorus as influenced by phytase supplementation was evaluated in broiler chickens. The experimental design consisted of a 3 x 4 x 2 factorial arrangement with three levels of digestible lysine (1.10, 1.30 and 1.50%), four levels of calcium (0.50, 0.70, 0.90 and 1.1%) and diets containing 0.35% AP with and without phytase for a total of 24 treatments. Remaining amino acids levels were adjusted with respect to the digestible lysine level using the ideal ratios suggested by Rostagno *et al.* (2005). Each experimental diet was fed to six replicates pens of five male chickens during 21 days. Body weight, FCR, feed intake, bone development (TD), bone mineralization (toe ash), and phosphorus excretion as Total Phosphorus in excreta (TP), Water Soluble Phosphorus in excreta (WSP) and the WSP/TP ratio were evaluated. Birds fed lysine levels higher than 1.1% expressed better body weight in a non-linear trend. Feed intake was decreased by increasing the lysine level while feed conversion improved as lysine level increased. Increasing levels of Ca decreased feed intake, the 1.1% Ca level was detrimental for body weight. Phytase supplementation was effective to alleviate widened-suboptimal Ca:P ratios in terms of feed intake and body weight. The 1.5% digestible lysine level improved toe ash; however, high levels of lysine were also related to a higher incidence of TD. Ca levels equal or greater than the NRC (1994) recommendation were adequate for optimum bone mineralization. Increasing levels of Ca reduced the incidence and severity of TD. Moreover, Ca levels greater than those suggested by NRC (1994) were adequate to assimilate higher lysine levels without compromising bone development. The higher lysine levels fed reduced TP in excreta but increased the WSP/TP ratio. The supplementation of phytase increased WSP and the WSP/TP ratio. Increasing levels of Ca reduced WSP and the WSP/TP ratio in excreta. Furthermore, high levels of Ca were also effective to overcome the increased WSP and WSP/TP ratio caused by the supplementation of phytase. (*International Journal of Poultry Science* 8 (4): 307-316, 2009; **doi**: 10.3923/ijps.2009.307.316)

Effect of Dietary Protein and Peptide in Corn-Soy Diets on Hen Performance, Egg Solids, Egg Composition and Egg Quality of Hy-Line W- 36 Hens During Second Cycle Phase Three

P. Gunawardana, G. Wu, Kun Yuan, M.M. Bryant and D.A. Roland, Sr.

A 5×2 factorial arrangement of five protein levels with and without Peptiva was conducted to evaluate the effect of Peptiva on performance, egg composition, egg solids, and egg quality of commercial Leghorns. Hy-line W-36 hens (n=1200, 98 weeks old) were randomly divided into 10 dietary treatments (8 replicates of 15 hens per treatment). The experiment lasted 12 weeks. Protein had a significant effect on feed consumption, egg weight, egg production, egg mass, egg specific gravity, egg albumen solids, and percent egg components. As dietary protein increased from 13.53 to 15.62%, egg production, feed consumption and egg weight increased by 6.14%, 8.2% and 5.18% respectively. Feed consumption of hens fed the diets supplemented with Peptiva was significantly lower than that of hens fed the diets without Peptiva. Peptiva supplementation also significantly increased egg production of hens during week 98 and numerically higher in week 99, 103, 105, 106, 107, 109 and overall egg production. There was also a significant effect of peptiva on egg mass and feed conversion during first week but the significant effects were lost after second week. Peptiva significantly decreased feed intake without causing any adverse effects on egg weight and egg production. Peptiva might be more beneficial for young hens. More research is needed with young hens to evaluate performance and profits of commercial layers at different egg and ingredient prices. (*International Journal of Poultry Science* 8 (4): 317-322, 2009; doi: 10.3923/ijps.2009.317.322)

Effect of Dietary Energy on Performance, Egg Components, Egg Solids, Egg Quality and Profits in Seven Commercial Leghorn Strains During Second Cycle Phase Two

P. Gunawardana, G. Wu, Kun Yuan, M.M. Bryant and D.A. Roland, Sr.

This study was a 3×7 factorial arrangement with three dietary energy levels (low, medium and high) and seven commercial Leghorn strains. The objective of this experiment was to determine the effect of increasing dietary energy on performance, egg composition, egg solids, egg quality, and profits in seven commercial Leghorn strains during second cycle phase 2 (from 88 to 97 week of age). This experiment lasted 10 weeks. Seven strains of hens (n=245 of each

strain) at 88 week of age were randomly divided into 21 treatments (6 replicates of 15 birds per treatment). Strain had a significant effect on feed intake, egg production, egg specific gravity, egg weight, percent whole egg solids, and haugh unit. There were no interactions between strain and dietary energy on any parameters during second cycle phase 2 (88 to 97 weeks of age). Dietary energy had no significant effect on any parameter. However as dietary energy increased, egg production, final body weight of hens, egg mass, egg yolk color and egg yolk weight numerically increased; moreover feed conversion numerically improved from 2.06 to 2.02, resulting in a 1.94% improvement of feed conversion. It is difficult to determine an ideal dietary energy level for the hens in second cycle phase 2 because increasing dietary energy had no significant effect on feed intake, egg mass and feed conversion. Because feed ingredient and egg price vary, there can be no fixed ideal dietary energy requirement for optimal profits. (*International Journal of Poultry Science* 8 (4): 323-327, 2009; *doi: 10.3923/ijps.2009.323.327*)

The Effect of Different Feed Restriction Programs and Dietary L-Carnitine Supplementation on Hepatic Lipogenesis, Plasma Heterophil to Lymphocyte Ratio and Yolk IgY Content of Broiler Breeder Hens

M. de Beer and C.N. Coon

Two experiments were conducted to determine effects of Everyday (ED) or Skip-a-day (SK) feeding and dietary L-carnitine on lipid metabolism and stress in broiler breeders. In Experiment 1 a 2x2 factorial design was used to compare feeding regimens (ED vs SK) and L-carnitine supplementation (0 vs 50 mg/kg). L-carnitine supplementation began at d 1 and lasted throughout the 45 weeks experimental period. SK programs were implemented from 28 days of age to 5% production. Parameters measured included *in vitro* Lipogenesis (IVL), Heterophil/Lymphocyte ratio (H/L) and yolk IgY content. Liver and blood samples were taken 1 h after feeding, at various intervals during the rearing and production periods. Both SK feeding and L-carnitine increased liver wts during rearing but differences dissipated after onset of lay. Part of the increase in liver weight in SK birds was due to higher lipid contents. L-carnitine tended to reduce liver lipid during rearing. IVL was increased by SK feeding during the rearing period. L-carnitine and SK feeding interacted to increase IVL at 20, 22 and 27 weeks. H/L was elevated at 7 weeks in SK birds, but no differences were observed after that. Neither L-carnitine nor feeding regimens affected maternal

IgY transfer to egg yolks. In Experiment 2, the same effects were tested but a low density grower diet was used from 4-18 weeks. The grower diet had 9% less energy and 7% less protein than in experiment 1. Liver wt was increased in SK and L-carnitine supplemented birds up to 20 weeks. By 40 weeks, ED birds had higher liver weights than SK. Liver fat was generally higher in SK birds than ED during rearing. SK feeding increased IVL but unlike Experiment 1, L-carnitine did not. H/L ratio was elevated in SK up to 20 weeks of age after which no differences occurred. L-carnitine did not affect H/L. In conclusion, feeding regimens and L-carnitine can alter hepatic lipid synthesis. Feeding regimens like SK, incorporating lengthy periods without feed can result in elevated H/L ratios but birds are generally able to adapt to such regimens over time. (*International Journal of Poultry Science* 8 (4): 328-341, 2009; *doi: 10.3923/ijps.2009.328.341*)

Effect of Different Calcium Sources and Calcium Intake on Shell Quality and Bone Characteristics of Laying Hens at Sexual Maturity and End of Lay

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The influence of supplemental calcium given in flour or granular form and calcium intake on bone properties and egg characteristics of brown-egg laying hens was investigated at sexual maturity and at end of lay. Physical and mechanical bone characteristics were determined using 3-point and torsional tests. There was no effect of calcium source on the measured bone characteristics at sexual maturity. Bone breaking strength was positively correlated with both stiffness and total calcium intake. At 72 weeks, birds which had been offered additional calcium of either source exhibited considerably higher bone breaking strength than did control birds. Bone stiffness of birds offered limestone granules was significantly higher than control birds. Regression analysis showed strong relationships between calcium intake, bone stiffness and breaking strength. Shell quality was significantly better for birds consuming limestone in a granular form than for control birds. Shell quality for birds given limestone flour was intermediate between the other two groups. It is concluded that calcium supplementation increases egg quality, mechanical properties of the bone and as a consequence, may be able to reduce the risk of broken bones at the end of laying period. These effects are independent of the form of the supplemented calcium. (*International Journal of Poultry Science* 8 (4): 342-348, 2009; *doi: 10.3923/ijps.2009.342.348*)

Influence of Herbal Early Chick Nutritional Supplement on the Growth Performance, Serum Biochemicals and Immune Response of Broiler Chicken

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The experiment was conducted on 150 day-old straight-run “Vencob” broiler chicks for a period of 6 weeks. Day old chicks were randomly divided into three groups I, II and III to evaluate effect of early chick nutritional polyherbal supplement AV/NNC/17 (supplied by Ayurved Ltd. Baddi, India) on the performance of broilers. The control group I was given basal diet 48 h after hatch. The group II and III were treated with 6 g and 8 g of AV/NNC /17 paste per chick immediately after hatching during transportation period/day till 48h and then switched over basal diet up to the age of marketing. The overall results of the study indicated that the early chick nutritional supplement AV/NNC/17 @ 6g and 8 g/chick has significant effect upon early growth, gain in weekly weight, feed efficiency and carcass traits between treatment and control indicating an overall beneficial effect of polyherbal product in initial 48 hours of life. In addition to these parameters, immune response, intestinal morphogenesis, intestinal development and gut health are also recorded to improve significantly in treatment groups. (*International Journal of Poultry Science* 8 (4): 349-354, 2009; *doi: 10.3923/ijps.2009.349.354*)

Nutrient Composition of Main Poultry Feed Ingredients Used in Sudan and Their Variations from Local Standard Tables Values

M.S. Babiker, C. Kijora, S.A. Abbas and J. Danier

Sorghum (Feterita), Groundnut Cake (GC), Sesame Cake (SC) and Wheat Bran (WB) are considered the main poultry feed ingredients in Sudan. Because the nutrient values of these ingredients are reported in the form of fixed figures in local standard tables, a study was undertaken to know if it is necessary to make analyses for feed ingredients before formulating the diets. Samples of the feed components were brought from local markets of Khartoum. Each sample was analyzed for proximate composition, minerals and amino acid contents. Considerable variations were observed between samples and the local standard table's values. Crude protein of sorghum (Feterita) was 16.65%, whereas Metabolizable Energy (ME) was 14.25 MJ/kg. Values for fat, fibre and ash were 3.86, 1.97 and 1.81%, respectively. Total concentrations of critical Amino Acids (AA) were: methionine, 0.2925%; lysine, 0.3501% and threonine, 0.4822%.

Levels of Calcium (Ca) and Phosphorus (P) were 0.03 and 0.41%, respectively. Crude protein of GC was 53.44%, whereas calculated ME was 11.80 MJ/kg. Values for fat, fibre and ash were 7.47, 8.55 and 5.27%, respectively. Total concentrations of critical AA for groundnut cake were: methionine, 0.4868%; lysine, 1.8185% and threonine, 1.4230%. The GC levels of Ca and P were 0.08 and 0.65%, respectively. Crude protein of SC was 44.42%, whereas calculated ME was 11.53 MJ/kg. Values for fat, fibre and ash were 13.11, 8.75 and 14.15%, respectively. Total concentrations of critical AA for SC were: methionine, 1.2852%; lysine, 1.0943% and threonine, 1.5449%. Levels of Ca and P were 1.93 and 1.17%, respectively. Crude protein of WB was 18.69%, whereas ME was 12.43 MJ/kg. Values for fat, fibre and ash were 4.88, 8.75 and 5.66%, respectively. Total concentrations of critical AA for WB were: methionine, 0.2676%; lysine, 0.8136% and threonine, 0.6036%. Levels of Ca and P for WB were 0.08 and 1.36%, respectively. The variation observed between samples and tables values strongly indicates that confirmatory analyses should be conducted prior to use of sample for formulating the poultry diets especially in the field of research. (*International Journal of Poultry Science* 8 (4): 355-358, 2009; *doi: 10.3923/ijps.2009.355.358*)

Serum Protein Profiles of Juvenile Ring-Necked Pheasants Vaccinated or Not Against Newcastle Disease

Elizabeth Moreira dos Santos Schmidt, Antonio Carlos Paulillo, Rosangela Locatelli-Dittrich, Olair Beltrame and Janine Denadai

The aim of this study was to investigate blood protein parameters in juvenile ring-necked pheasants using Ulster 2C, B1 and LaSota vaccines strains of the Newcastle disease virus. Total serum protein, albumin and globulin concentrations showed significantly differences among vaccinated and non-vaccinated birds. Significant variations were not observed in the analyses in relation to protein electrophoresis profile. (*International Journal of Poultry Science* 8 (4): 359-362, 2009; *doi: 10.3923/ijps.2009.359.362*)

The Use of Linear Mixed Models to Estimate Optimal Vaccination Timing for Infectious Bursal Disease in Broilers in Paraguay

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The objectives of this study were (1) to fit linear mixed models for Maternally Derived Antibody (MDA) values for estimating optimal days of age for Infectious

Bursal Disease (IBD) vaccination in broiler chicks and (2) to evaluate how optimal vaccination timing estimates varied, based on the field data collected in Paraguay. The MDA titres were measured by Enzyme-linked Immunosorbent Assay (ELISA) with sera collected from 20 chicks per flock ($n = 14$) at 1, 8 and 15 days of age. Both Restricted Maximum-likelihood (REML) and Markov Chain-Monte Carlo (MCMC) estimation methods were used to fit linear mixed models for the dependent variable log-transformed MDA. There is a slight dissimilarity of each estimate between the two models because of the difference in mathematical algorithms and handling method of missing data. The study flocks with the earliest and latest estimated optimal timing for vaccination had a mean days of age of 15.1 [95% Bayesian Credible Interval (BCI): 13.3-17.0] and 23.7 [95% BCI: 21.7-25.7], respectively. This variation could be partly explained by a limited understanding of the true biological variability representing the variety of factors affecting MDA in the study chicks. Although the results of the study can be used as a benchmark to establish IBD vaccination programmes in the study area, it is recommended for estimating optimal IBD vaccination timing to measure the MDA level by ELISA tests on a routine basis. (*International Journal of Poultry Science* 8 (4): 363-367, 2009; *doi*: 10.3923/ijps.2009.363.367)

Comparative Study of Thigh Muscles and Bones Conformation and Some Carcass Traits of Local vs. Imported Turkey Strain

N.T. Taha and M.T. Farran

Four males and four females of each of imported BUT-9 and local strain of turkey were slaughtered at marketing age, to study live body weight, som carcass traits, in addition to drumstick's bones at Tibia region "Nazarian bones²" which radiography and chemically analyzed for fat-free bone parameters. The results indicated that BUT-9 revealed higher ($p < 0.05$) live body weight, ready to cook carcass weight percent (dressing percent), breast weight and percent, left drumstick weight and percent as compared with local strain of turkey. BUT-9 strain also significantly ($p < 0.05$) had more number of drum-stick's muscles, tibia weight and width, drum-stick's thickness and width and drum-stick's bones percent. However, local strain had significantly ($p < 0.05$) more drumsticks bones "Nazarian bones" while BUT-9 had no Nazarian bones in their drum-stick's muscles. Males had more ($p < 0.05$) live body weight, neck, drum-stick's width, length and tibia length, breast weight, width and depth and shank weight as a percent of live body weight. As compared with fibula there were no significant differences between those bones and fibula for dry matter, phosphorus and magnesium percents, while a significant ($p < 0.05$) differences were noticed for ash and calcium. But fat percent didn't show any significant differences between Nazarian bones themselves but

were noticed with fibula. Sex had no significant effect on bone parameters except for males turkey bones which had more ($p<0.05$) dry matter than females. (*International Journal of Poultry Science* 8 (4): 368-372, 2009; doi: 10.3923/ijps.2009.368.372)

The Effect of Feed Restriction Programs and Growth Curves on Reproductive Performance, *in vitro* Lipogenesis and Heterophil to Lymphocyte Ratios in Broiler Breeder Hens

M. de Beer and C.N. Coon

An experiment was conducted to compare Everyday (ED) and Skip-a-day (SK) feeding programs and early Slow growth (SLOW) and Broilerized (BROIL) treatments. Feed restriction programs were implemented from 4 weeks to 5% production. The SLOW group was fed to reach 75% of standard BW by 12 weeks and then to reach standard BW by 21 weeks. The BROIL group was fed *ad libitum* till 7 weeks and then severely restricted to reach standard BW by 21 weeks. Parameters measured included BW, uniformity, age at Sexual Maturity (SM), total and settable egg production, body composition, liver size and composition, *in vitro* Lipogenesis (IVL) and Heterophil-Lymphocyte ratio (H/L). Breeder production performance was evaluated through 45 weeks of age. Birds fed ED grew more efficiently than SK or SLOW. The BROIL treatment resulted in significantly worse feed utilization than all other groups. Frame size was consistently greater in BROIL pullets and consistently smaller in SLOW pullets. Birds fed ED reached SM before SK, who in turn reached SM before SLOW or BROIL birds. Egg production was significantly higher in ED than SK, which in turn was higher than either SLOW or BROIL. The difference of nearly 17 total eggs per hen between ED and BROIL hens could not be explained by differences in BW or body composition. Liver weight and IVL was elevated in SK and SLOW pullets above ED pullets during rearing. Liver weight and IVL were lower in BROIL pullets than other groups during rearing, but after photostimulation dramatic increases in liver weight and IVL resulted in this trend being inverted by 27 weeks. As an indicator of stress, H/L ratios were elevated above ED pullets in SK, SLOW and BROIL pullets at various times during rearing. These times generally coincided with the periods of most severe feed restriction. Feeding regimens and growth curves have a major influence on efficiency and reproductive performance in broiler breeders. These effects were not attributable solely to differences in BW and body composition. The depression of IVL in broilerized pullets even after restricted feeding was implemented was of great interest and warrants further examination. (*International Journal of Poultry Science* 8 (4): 373-388, 2009; doi: 10.3923/ijps.2009.373.388)

Evaluation of the Production Performances of an Endangered Local Poultry Breed, the Famennoise

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The Famennoise is a Belgian poultry breed which is greatly endangered. Like most of the local breeds in this situation, the Famennoise remains largely unknown and is representative of the continuous loss of genetic diversity that is threatening the future of animal production. From preliminary results, egg production traits in this breed showed valuable economic assets. The present study is, thus, aimed at assessing its production performances with the prospect that it might be conserved for future valorization. Egg production as well as growth traits were estimated. Both aspects showed exploitable performances. In absence of past selection for these traits, eggs presented a mean weight of 55.43 ± 3.03 g, so being in the middle class of marketable eggs, a yolk to albumen ratio of 50.7 ± 5.02 %, an eggshell resistance (maximal force of breakage of 36.03 ± 3.3 N) equal to commercial strains and superior to already valorized local breeds. In broilers, a mean weight 980.67 ± 16.62 g was reached at 8 weeks, 1815.90 ± 36.55 g at week 12 and 2191.90 ± 48.31 g at week 15. The Famennoise is, therefore, suggested for use as a dual-purpose breed with a good potential of selection for both productions. It could further serve in crosses for improvement of commercial strains. In conclusion, it appears to be highly urgent to screen endangered local poultry breeds for economically exploitable traits which would motivate conservation programs of biodiversity, before this extraordinary scientific and economic potential get irremediably lost. (*International Journal of Poultry Science* 8 (4): 389-396, 2009; *doi*: 10.3923/ijps.2009.389.396)

Effect of Graded Level of Alphamune G on Performance, Blood Chemistry and Histology of Cockerel Chicks

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A study was conducted to determine the response of day-old cockerel chicks to graded levels of Alphamune G (0.00, 0.04, 0.05 and 0.06%). The experiment which was conducted for 8 weeks employed a completely randomized design. Feed intake and nutrient retention were not significantly influenced ($p > 0.05$) by dietary inclusion levels of Alphamune G. However, weight gain and feed to gain ratio were significantly improved ($p < 0.05$) for cockerel chicks fed 0.06% inclusion level when compared with the control. The values were 7.78 and 4.58 g/bird/week, respectively. Haematology and serum indices did not show any

significant effect as a result of the graded levels of dietary Alphamune G. Histological characteristics revealed slight morphological changes in specific organs of birds fed Alphamune G supplemented diet vis-a viz the control diet. Inclusion of Alphamune G at 0.06% in the diets of cockerel chicks gave the best performance. (*International Journal of Poultry Science* 8 (4): 397-400, 2009; *doi*: 10.3923/ijps.2009.397.400)

Study on Immunomodulatory Activity of Dietary Garlic in Chickens Vaccinated against Avian Influenza Virus (Subtype H₉N₂)

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Fresh garlic powder was evaluated for ability to potentiate the immune response of broiler chicks to Avian Influenza Virus (AIV) vaccine. For this purpose, 280 day-old chicks (Ross 308) were randomly allocated to 4 groups A, B (52 each) C and D (88 each). The birds in groups A and B were given control diet during the experiment, but those in groups C and D received diet supplemented with 1 and 3% garlic powder, respectively. After 2nd bleeding, half of the chicks in groups C and D were separated as groups E and F and fed control diet thereafter. On 9th day of age, the chicks in all groups except A were immunized subcutaneously against AIV (subtype H₉N₂) with a commercial oil-based inactivated vaccine (Merial, France). Fifteen chicks from each group were bled on days 14, 24 and 34 post vaccination and also 5 just before vaccination. The sera were used for antibody titration against AIV by both HI and ELISA tests. The results showed that antibody levels were considerably higher in the vaccinated chicks than those in the non-vaccinated control throughout the experimental period ($p < 0.05$) but not affected by the treatment ($p > 0.05$). In addition, the removal of garlic from diet had no significant ($p > 0.05$) effect on serum titer. It is suggested that diet supplementation with garlic powder can not stimulate the humoral response of chickens against AIV vaccine. (*International Journal of Poultry Science* 8 (4): 401-403, 2009; *doi*: 10.3923/ijps.2009.401.403)

Antibiotic Resistance in Poultry

D.F. Apata

The worldwide increase in the use of antibiotics as an integral part of the poultry and livestock production industry to treat and prevent infectious bacterial diseases and as growth promoters at sub-therapeutic levels in feeds has led to the problem

of the development of bacterial antibiotic resistance during the past years. Recent scientific evidence has shown that resistance to antibiotics is not only due to the natural ability of a tiny fraction of the bacteria with unusual traits to survive antibiotic's attack, enabling resistant strains to multiply, but also stems from the transmissibility of acquired resistance to their progeny and across to other unrelated bacteria species through extrachromosomal DNA fragment called the plasmid which provide a slew of different resistances. The emergence and spread of resistant bacterial strains like *Campylobacter* sp, *Escherichia coli* and *Enterococcus* sp. from poultry products to consumers put humans at risk to new strains of bacteria that resist antibiotic treatment. Resistant bacteria thwart antibiotics by interfering with their mode of action via a range of effectors' mechanisms, including synthesis of inactivating enzymes, alteration in the configuration of cell wall or ribosome and modification of membrane carrier systems. These mechanisms are specific to the type of resistance developed. Because of the growing global concerns that resistance bacteria can pass from animals to humans, there is an increase in public and governmental interest in phasing out inappropriate antibiotic use in animal husbandry. Improvement in the hygienic practice of handling raw animal products and adequate heat treatment to eliminate the possibility of antibiotic resistant bacteria surviving may play a role in preventing the spread. More attention should be focused on increasing antibiotic surveillance capacity to cope with the spread of emerging resistances and on the alternative approach to sub-therapeutic antibiotics in poultry, especially the use of probiotic micro-organisms that can positively influence poultry health and produce safe edible products. (*International Journal of Poultry Science* 8 (4): 404-408, 2009; *doi*: 10.3923/ijps.2009.404.408)

The Effect of Different Feed Restriction Programs and Dietary L-Carnitine Supplementation on Reproductive Performance, Efficiency, Frame Size and Uniformity in Broiler Breeder Hens

M. de Beer and C.N. Coon

Two experiments were conducted to determine the effect of Everyday (ED) or Skip-a-day (SK) feed restriction programs and L-carnitine supplementation on breeder reproductive performance. In Experiment 1 a 2 x 2 factorial design was used to compare feeding regimens (ED vs. SK) and L-carnitine supplementation (0 vs 50 mg /kg). L-carnitine supplementation began at day 1 and lasted throughout the 45 week experimental period. SK feeding programs were implemented from 28 days of age to 5% production. Feed allocation was adjusted to ensure equal BW between groups. At 21 weeks, 60 pullets from each treatment combination were housed individually. Feeding ED improved the feed conversion

ratio by 0.24 units for 21 week pullets, resulted in 3 days earlier attainment of Sexual Maturity (SM), produced 4.6 more total eggs and 5.0 more settable eggs than SK fed pullets. Uniformity was less for ED fed pullets (2.07 higher CV). Egg size was increased by 1.16g with dietary L-carnitine. Body composition was not affected by either feeding regimen or L-carnitine. In Experiment 2, the same effects were tested but a low density grower diet was used from 4-18 weeks. L-carnitine was supplemented from day 1 and SK programs began at day 28 and extended to 5% production. Feed allocation was adjusted to maintain equal BW and 80 pullets per treatment were individually housed at 21 weeks. L-carnitine and ED feeding through 21 wk improved the FCR by 0.06 and 0.12 units, respectively. Feeding ED resulted in 5.8 days earlier SM, 4.7 more total eggs and 4.4 more settable eggs than SK. Uniformity was not affected by feeding regimen or L-carnitine. Carcass fat was reduced and carcass ash was increased by L-carnitine supplementation at 22 weeks. It was concluded that ED fed breeders are more productive than SK fed breeders primarily because of earlier SM. ED fed breeders are more efficient than SK breeder pullets because there are less nutrients wasted for tissue replenishment. Feeding breeder pullets ED with low energy density diets helped eliminate uniformity differences for pullets fed ED and SK feeding regimens. Breeders fed L-carnitine during 21 wk rearing period improved the FCR by 0.06 units for both Experiment 1 and 2. While, the effect of L-carnitine on total egg production was not significant, L-carnitine supplemented birds produced 3.9 and 2.7 more total eggs at 45 weeks than non-supplemented birds in Experiments 1 and 2 respectively. The consistency of the results and the associated p-values ($p = 0.12$; $p = 0.13$) for total egg production in the two experiments suggest that L-carnitine may have some beneficial effects on egg production. Breeders fed carnitine also showed significant increases in EW in Experiment 1 and near significant ($p = 0.13$) increases in EW for the second experiment. Carnitine was unable to attenuate the negative effects of SK feeding associated with the lengthy fasting periods. (*International Journal of Poultry Science* 8 (5): 409-425, 2009; *doi*: 10.3923/ijps.2009.409.425)

Ephrin Receptor Expression in the Embryonic Bursa of Fabricius

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Utilizing degenerate PCR primers complementary to conserved regions within the kinase domain of Receptor Tyrosine Kinase (RTK) genes, the goal was to compare the full complement of RTK expressed (mRNA level) between two developmental stages of bursal B-cells. We identified 21 different RTK cDNAs

out of a total of 235 cDNAs sequenced between the two B-cell stages. The dataset revealed the expression of RTK genes important in developmental processes, namely the ephrin receptors (Eph). The ephrin receptors and the ephrin ligands play critical roles in embryo development by controlling the organization of cells in tissues and by inducing cellular differentiation. (*International Journal of Poultry Science* 8 (5): 426-431, 2009; **doi:** 10.3923/ijps.2009.426.431)

Effect of Some Water Supplements on the Performance and Immune System of Chronically Heat-Stressed Broiler Chicks

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Effects of water supplements, sodium bicarbonate (NaHCO_3), potassium chloride (KCl) and acetic acid were evaluated on the performance and immune system of chronically heat-stressed broiler chicks. Two hundred day old broiler chicks were allotted to one of the four groups (n = 50); 1) control [no supplements], 2) NaHCO_3 , 0.5%, 3) KCl, 0.15% and 4) acetic acid, 1.5 mL/Liter. All chicks were kept in a controlled environmental chamber maintained at $33 \pm 2^\circ\text{C}$ from day one to 6 weeks (wks) of age. Significantly higher weight gains coincided with decreased feed conversion ratios for all the supplemented groups as compared to control group at 2, 4 and 6 wks of age. Bursal index, percentage weights of thymus and spleen in relation to body weight and natural agglutinin levels, an indicator of humoral immunity were higher but the heterophil:lymphocyte ratio, an indicator of stress was lower for the supplemented groups as compared to control group. Total aerobic spore formers and *Enterobacterae* counts in the intestinal swab samples were higher in control group than supplemented groups. Intestinal pH was lower at 2, 4 and 6 weeks of age but water consumption at 5 and 6 wks of age tended to be higher in acetic acid treated group as compared to other groups. Overall, the results indicated significant improvement in the performance and immune response of chronically heat-stressed broiler chicks given the water supplements, acetic acid being slightly superior to NaHCO_3 and KCl. (*International Journal of Poultry Science* 8 (5): 432-436, 2009; **doi:** 10.3923/ijps.2009.432.436)

The Effects of Intra-Amnionic Feeding of Arginine And/or β -Hydroxy- β -Methylbutyrate on Jejunal Gene Expression in the Turkey Embryo and Hatchling

O.T. Foye, C. Ashwell, Z. Uni and P.R. Ferket

In-ovo Feeding (IOF), injecting nutrients into the amnion of the developing embryo may enhance post-hatch growth by enhancing intestinal expression and

function prior to hatch. This hypothesis was evaluated with IOF solutions of Arginine (ARG), HMB and Egg White Protein (EW) in turkeys. Four treatments were arranged as a factorial of 2 levels of ARG (0 and 0.7%) and HMB (0 and 0.1%). An IOF solution of EW (18%) was evaluated for contrast. At 23 d of incubation (23E) each IOF solution was injected into the amnion. Upon hatch all poult were fed *ad libitum*. Intestinal mRNA of the digestion/absorption related genes Sodium Glucose Transporter (SGLT), Peptide transporter (Pept), Sucrase-isomaltase (SI) and Aminopeptidase (AP) were determined at 25E, hatch, 3 and 7 d by real-time PCR analysis. The data was analyzed as a 2X2 factorial and 1-way ANOVA for contrast. There were significant ARG X HMB effects on Pept, SGLT, SI and AP mRNA levels at hatch. IOF HMB alone enhanced Pept, SGLT, SI and AP intestinal mRNA expression at hatch, whereas inclusion of ARG depressed expression. There were main and independent effects of HMB or ARG on mRNA expression of SI and AP at 25E, in which ARG alone depressed expression, while IOF HMB alone had no effect on SI or AP expression. These results suggest that IOF may enhance early growth by improving intestinal capacity to digest and absorb nutrients at hatch which may fuel more rapid post-hatch growth. (*International Journal of Poultry Science* 8 (5): 437-445, 2009; **doi**: 10.3923/ijps.2009.437.445)

Reproductive Performance of the Ardennaise Chicken Breed under Traditional and Modern Breeding Management Systems

J-M. Larivière, C. Michaux, F. Farnir, J. Detilleux, V. Verleyen and P. Leroy

Enhancing the use of traditional chicken breeds is necessary to insure long-term conservation of global genetic diversity in poultry. A logical start in this process is to evaluate performance. The objective of this study was to estimate reproductive traits in the Ardennaise chicken breed under traditional and modern management systems. Reproductive performance indicated lighting programs [Natural (NAT) or Artificial (ART) day length] were highly significant for egg weight, hatchability ($p \leq 0.001$), early and mid-term embryonic mortality ($p \leq 0.01$). Feeding treatments [*ad libitum* (AL) or mild Feed-restriction (FR)] varied greatly with egg weight, hatchability, fertility ($p \leq 0.001$) and late embryonic mortality ($p \leq 0.05$). Most precocious age at first egg (23 weeks), longest duration of laying period (>27 weeks), utmost maximum production peak (56.67%), largest egg number (70.13 eggs/hen) and number of chicks hatched (24.10 chicks/hen) were performed under ART-AL. Heaviest egg weight (53.21g), highest fertility (70.20%), greatest hatchability (55.58%), highest liveability during rearing (95.74%) and lay (100%), lowest early (3.51%) and mid-term embryonic

mortality (1.17%) were achieved under NAT-AL. To summarize, most of traits studied in the Ardennaise chicken were moderate when compared to those expected by broiler breeders. (*International Journal of Poultry Science* 8 (5): 446-451, 2009; *doi*: 10.3923/ijps.2009.446.451)

Performance, Breast Morphological and Carcass Traits in the Ardennaise Chicken Breed

J.M. Larivière, F. Farnir, J. Detilleux, C. Michaux, V. Verleyen and P. Leroy

The aim of this study was to quantify performance, breast morphological and carcass traits in Belgium's most ancient chicken breed: the Ardennaise. Evaluation during growing showed at 84 days of age light as-hatched mean live Body Weights (BW) ($1115\text{g} \pm 221$), fairly high Feed Conversion Ratio (FCR) (5.09 ± 0.4) and Liveability (LIV) ($92.55\% \pm 4.6$). At 85 days, male and female *in vivo* breast measurements such as Keel Angle (KA) ($67.74\text{-}71.82^\circ$), Thoracic Circumference (TC) ($25.61\text{-}28.05\text{ cm}$), Keel Length (KL) ($10.32\text{-}11.26\text{ cm}$) and muscle thickness (TM) ($10.70\text{-}12.11\text{ mm}$), with associated BW, were all greater in males and significantly different between sexes ($p < 0.001$), except for Chest Width (CW) ($4.62\text{-}5.35\text{ cm}$). However, there was no sexual dimorphism for all yield traits. Yields of Eviscerated Carcass (EC) varied from 57.54-59.28%, Thighs and Drumsticks (TD) from 19.37-19.80%, Breast Meat (BM) from 11.02-11.62% and Wings (WI) from 8.67-8.82%. All *in vivo* measurements, carcass and portions data were lower than those reported mostly for broilers, except similar KA degrees and slightly higher WI. Finally, most of traits studied in the Ardennaise chicken were moderate when compared to those obtained by broilers. (*International Journal of Poultry Science* 8 (5): 452-456, 2009; *doi*: 10.3923/ijps.2009.452.456)

Effects of Ascorbic Acid on Rectal Temperature Fluctuations in Indigenous Turkeys During the Hot-Dry Season

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Experiments were performed on 40 indigenous turkeys with the aim of investigating fluctuations in their rectal temperature (RT) and the effect of ascorbic acid (AA) on during the hot-dry season. Twenty turkeys which served as experimental birds were administered AA orally at the dose of 52 mg kg^{-1} , while the remaining 20 turkeys which served as control were given ordinary water. Measurements of RT were taken for 3 days, one week apart and every hour from

06:00-19:00 h. The results showed that RT values in both experimental and control turkeys significantly ($p < 0.01$) fluctuated with the hours of the day ($r = 0.614, 0.612$, respectively) and the dry-bulb temperature ($r = 0.794, 0.928$, respectively). The RT value of $41.2 \pm 0.03^\circ\text{C}$ recorded in experimental turkeys was significantly lower ($p < 0.05$) than the corresponding value of $41.5 \pm 0.03^\circ\text{C}$ obtained in control turkeys. The results demonstrated that AA significantly reduced RT values in experimental turkeys. In conclusion, AA administration may be of value in turkeys subjected to unavoidable stressful conditions during the hot-hours of the day. (*International Journal of Poultry Science* 8 (5): 457-461, 2009; *doi: 10.3923/ijps.2009.457.461*)

Assessment of Pathogenic Potential of Avian Influenza Viruses by MDCK Cell Culture

B.P. Shankar, R.N. Sreenivas Gowda, B. Pattnaik, B.H. Manjunatha Prabhu, R.P. Kamal, B.K. Sreenivas, H.S. Madhusudhan, D. Ranjith and H.K. Pradhan

The influenza viruses are sub-classified in to two pathotypes of Highly Pathogenic Avian Influenza (HPAI) and Low Pathogenic Avian Influenza (LPAI) viruses on the basis of the pathogenicity of AIV in domestic poultry. Samples of H5N1 (7966/06 and 7972/06) and the H9N1 (5844/05) viruses were also grown on MDCK cell. All these produced cytopathic effect within 72 h. Normally, the nonpathogenic AIV does not produce CPE in MDCK cells. However, CPE can be produced if trypsin is incorporated while, culturing the viruses. In the present study, without the addition of trypsin the viruses produced CPE. On FAT both cytoplasmic and nuclear florescence was observed. It is also known that the viruses which produce CPE in absence of trypsin are pathogenic. It proved beyond that the H5N1 and H9N1 viruses isolated in the present study were pathogenic based on cell culture study. (*International Journal of Poultry Science* 8 (5): 462-464, 2009; *doi: 10.3923/ijps.2009.462.464*)

Identification and Subtyping of Avian Influenza Viruses by Reverse Transcription Polymerase Chain Reaction (RT-PCR) and Agarose Gel Electrophoresis

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Avian Influenza (AI) is caused by type A influenza virus belonging to the family *orthomyxoviridae*, which is classified into 16 HA and 9 NA subtypes based on

two surface glycoprotein's haemagglutinin (HA) and neuraminidase (NA). In the present study we did identification and HA-subtyping of avian influenza virus by reverse transcription-PCR (RT-PCR) during the first outbreaks of AI in India during 2006. The avian influenza virus is identified by RT-PCR using a set of primers specific to the nucleoprotein (NP) gene of avian influenza virus. The HA-subtypes of avian influenza virus were determined by running with HA subtype specific primers for H5, H7 and H9 RT-PCR reactions, each using a set of primers specific to one HA-subtype. A total of 10,236 tissue / cloacal swab samples, received at the HSADL from various parts of the country, were processed for isolation of AI virus in embryonated chicken eggs. Out of these, 9 samples originating from poultry in Maharashtra (Navapur and Jalgaon) and Gujarat (Surat) states of India were found positive for H5 virus by RT-PCR. All samples received from outbreaks areas were tested by using all three subtype specific primers (H5, H7 and H9) only H5 RT-PCR reactions gave the product of expected size, and thus the HA-subtype of the virus is determined. One sample gave the positive result with H9 subtype specific primers. The RT-PCR procedure is rapid and sensitive, and could be used for the identification and HA-subtyping of avian influenza virus in organ homogenates. (*International Journal of Poultry Science* 8 (5): 465-469, 2009; *doi*: 10.3923/ijps.2009.465.469)

Long-Term Effects of Oxymetholone vs. Testosterone with or Without ZnSO₄ on Growth Performance of Turkey Chicks

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Oxymetholone at 0.6 mg/kg feed or mixed with ZnSO₄ (45mg/kg feed), testosterone at 10 mg/kg feed or mixed with ZnSO₄ (45 mg/kg feed) and 0 mg/kg of either one were given to 180 turkey chicks (n = 9; r = 4) from 6-18 weeks of age to determine their effects on growth performance. Body Weight (BW) was increased gradually in all treatments when compared to the control group with the highest level for oxymetholone and testosterone alone respectively. Feed Intake (FI) during 12 weeks of study decline slightly in all treatments with the lowest level for oxymetholone + ZnSO₄ and the highest level for control group. Feed Conversion Ratio (FCR) at the end of study was 4.77 for control group and 4.15, 4.32, 4.50 and 4.69 for different treatments, respectively. Growth Rate (GR) differed for each week and treatment. Overall, the treatment groups showed higher GR when compared to control group in every week. The percentage of Carcass Weight (%CW) was increased significantly (p<0.05) in all treatments in comparison with control group with highest level for testosterone + ZnSO₄. The

treatments did not influence significantly on the internal organs by the end of study. Oxymetholone induced BW and %CW ($p < 0.05$) with less FI and FCR when compared to testosterone and control group in turkey chicks. (*International Journal of Poultry Science* 8 (5): 470-474, 2009; doi: 10.3923/ijps.2009.470.474)

Effect of Dietary Graded Levels of *Leucaena leucocephala* Seeds on Layers Performance, Egg Quality and Blood Parameters

Mohamed Elamin Ahmed and Khadiga Abbas Abdelati

The layers experiment was conducted to evaluate the effect of different levels of leucaena seed (0, 8, 16 and 24%) on 27 weeks of old laying hens. Parameters studied were egg production, external and internal quality characteristics of eggs, haematological indices and plasma constituents. Feed intake, hen-day egg production, FCR (kg feed/kg egg) and FCR (kg feed/dozens of egg) were depressed with the inclusion of leucaena seeds. Thereafter, birds were placed on control diet for two weeks, which revealed improvement of the performance except for FCR (kg feed/dozens of egg) for birds fed 24% leucaena seeds. Higher egg weight, maximum length and egg shell surface were recorded for birds fed 16% leucaena seeds compared to the others. Maximum width, shell weight and shell% were reduced for birds fed 24% leucaena seeds. Internal quality characteristics of eggs were not significantly affected by the dietary treatments except albumin weight, albumin%, yolk index and yolk color score. Yolk color score consistently increased with the inclusion of leucaena seeds. (*International Journal of Poultry Science* 8 (5): 475-479, 2009; doi: 10.3923/ijps.2009.475.479)

Comparison of Constraints to Poultry Producers in Delta State Nigeria

Bishop O. Ovwigho, F.U.C. Mmereole, I. Udeh and P.O. Akporhwarho

The study was an inter-disciplinary one designed to investigate the constraints relevant to different poultry production systems. The sample size was 241 poultry farmers made up of extensive (210), semi-intensive (5) and intensive (26). A four-point rating scale was used to measure the constraints. Mean, Analysis of variance and correlation matrix were used in data analysis. The constraints faced by the extensive poultry farmers were inability to diagnose sick birds ($M = 3.45$), lack of

market for eggs (M = 2.52), egg cracking (M = 2.98), lack of finance (M = 3.44) and loss of birds/eggs to thieves, predators and hazards (M = 3.17). The constraints faced by semi-intensive poultry producers were inability to diagnose sick birds (M = 4.00), lack of feeds (M = 3.00), transportation difficulties (M = 2.80), loss of birds and eggs to predators, thieves and hazards (M = 2.60), lack of finance (M = 3.80) and egg cracking (M = 3.40). The constraints to intensive poultry producers were mortality of adult birds (M = 2.85), diseases outbreak (M = 2.58), lack of feeds (M = 2.88), transportation difficulties (M = 3.23), lack of finance (M = 2.65), feather pecking/cannibalism (M = 3.00) and difficulties in sourcing for day-old chicks (M = 2.65). Lack of finance was a common constraint in the three systems of poultry production. There was a significant difference ($p < 0.05$) in the responses of the extensive, semi-intensive and intensive poultry farmers to the constraints facing poultry production in the study area. Adequate finance is needed to boost poultry production in the study area. (*International Journal of Poultry Science* 8 (5): 480-484, 2009; doi: 10.3923/ijps.2009.480.484)

Growth and Haematological Response of Broiler Chicks Fed Graded Levels of Sweet Potato (*Ipomoea batata*) Meal as Replacement for Maize

E.A. Ayuk and A. Essien

The study was conducted to find out the performance and haematological response of broiler birds fed different levels of sweet potato meal (SPM). The levels of sweet potato meal in the different treatment rations were 0, 10, 20, 30, 40 and 50%, respectively. There was a curvilinear decline in growth rate (from 27.9 to 23.3 g/day) as the maize was replaced by sweet potato root meal with a pronounced reduction in performance overall of 17% when all the maize was replaced by sweet potato meal. All haematological parameters assessed only showed minor numerical ($P > 0.05$) differences, falling within the ranges stated in literature. It is concluded that sweet potato root meal can replace maize meal in the diet of broilers over the weight range 50 to 1400 g, with only a slight reduction in growth rate (17% with complete substitution of maize), which may be compensated by the lower cost of the sweet potato meal. The substitution also did not have any deleterious effect on haematological and by extension, the health status of the birds. (*International Journal of Poultry Science* 8 (5): 485-488, 2009; doi: 10.3923/ijps.2009.485.488)

Weight Gain and Haematological Profile of Broiler Chicks Fed a Maize-Soyabean Diet Supplemented with Different Levels of Methionine, Sodium Sulphate and Sodium Sulphite

S.O. Akpet, A. Essien, E.E. Orok, S.C. Etop and B.A. Ukorebi

An experiment was carried out to investigate the effect of substituting synthetic methionine with sodium sulphate and sodium sulphite in maize-soyabean diets fed to broiler chicks on weight and haematological profile. Two hundred and forty (240) unsexed Hubbard day old broiler chicks were fed iso-caloric and iso-nitrogenous maize-soyabean diets (3,000 cal/kg and 22% crude protein) for four weeks. There were eight treatment groups, T1-T8, each replicated three times. T1 had no methionine, T2 had 3% methionine, T3 had 3% sodium sulphate, T4 had 3% sodium sulphite, T5 had 1.5% methionine and 1.5% sodium sulphate, T6 had 1.5% methionine and 1.5% sodium sulphate T7 had 1.5% methionine and 1.5% sodium sulphite while T8 had 1.5% methionine and 1% sodium sulphite. Chicks in T6 had the highest average weekly weight gain of 106.58 g while birds in T8 had the lowest average weekly weight gain (79.94 g). The average weekly weight gain of birds in T1, T2 and T5 did not differ significantly ($p>0.05$) from one another. Likewise the average weekly weight gain of birds in T1, T2, T3 T4 and T5 did not differ significantly ($p>0.05$) from one another. The average weekly weight gain of chicks in T7 and T8 which had the lowest weight gains, also did not differ significantly ($p>0.05$). All haematological parameters evaluated fell within safe precincts as stipulated in literature. Treatment 6 is therefore recommended for broiler starter rations alongside T2 and T5 because they did not differ significantly ($p>0.05$) from one another. (*International Journal of Poultry Science* 8 (5): 489-492, 2009; *doi*: 10.3923/ijps.2009.489.492)

Nucleocapsid Gene Sequence Analysis and Characterization of an Indian Isolate of Avian Infectious bronchitis virus

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Avian Infectious bronchitis virus belongs to the family *Coronaviridae*. It is an enveloped virus with large positive stranded RNA genome. In the present study RNA was isolated from viral suspension and transcribed into cDNA. Poultry postmortem cases showing lesions of visceral gout were collected and infectious bronchitis virus were isolated. About 1.2 kb Nucleocapsid gene of virus was amplified by RT-PCR from four clinical samples. The amplified product was cloned and the nucleotide sequence of the N gene of an Indian field isolate was determined. The Indian IBV isolate exhibited 95% homology with Korean isolates

and Chinese vaccine strains indicated conserved nature of N gene. Haemagglutination assay and chicken embryo inoculation was carried out for antigenic studies of the virus. The virus titre was confirmed using haemagglutination assay and IBVN2 showed the 1:2048+ titre. Propagation of virus was done by chorioallantoic method of inoculation of virus suspension in embryonated eggs. Characteristic curling and dwarfing of embryos was noticed in CAM inoculated embryonated eggs. Inoculated eggs showed teratogenic changes and deposition of urates as indication of nephropathogenic nature of virus. (*International Journal of Poultry Science* 8 (5): 493-499, 2009; *doi*: 10.3923/ijps.2009.493.499)

Adoption of Vaccination Against Newcastle Disease by Rural Poultry Women Farmers in the North Central Zone of Nigeria

O.J. Saliu, M.E. Sanda and S.I. Audu

Newcastle disease is now claimed to be responsible for 70-80% of annual death in village chickens. Losses in hundreds of poultry birds of various ages and sexes in Ijumu local government area in the north central zone of Nigeria is attributed to the disease. The prevalence is always at its peak during the dry season (Hamattan) of every year in the last decade. Live Newcastle vaccines such as intra ocular, B1 strain, LaSota and Komorov have been produced by National Veterinary Research Institute (NVRI) vom to prevent the occurrence of the disease. Structured questionnaire was designed to quest for adoption of the Newcastle vaccination from 107 poultry women farmers in the study area. The level of awareness of the vaccination was about 70% while, only 11.21% adopted the vaccination alone and 34.58% adopted both the vaccination and ethnoveterinary treatments. Age contributed positively (14.9%) but not significantly to the adoption of the vaccination. This implies that the adoption of the vaccination still need much extension service effort for improvement. This study recommends that both private and public extension outfit should make complementary effort to improve the adoption of the vaccination by the rural women. (*International Journal of Poultry Science* 8 (5): 500-503, 2009; *doi*: 10.3923/ijps.2009.500.503)

Genotype by Diet Interaction on Body Weight of the Local Chicken and its Crosses with Barred Plymouth Rock

F.U.C. Mmereole and I. Udeh

In a 2x4 factorial arrangement, the effect of genotype, diet and their interaction on body weight and weight gain of the F₁ crosses between the local chicken and Barred Plymouth Rock were investigated. Birds of each genotype were separated into two dietary groups at day old. One group was placed on layer type diets and

other on broiler type diet. The body weights and weight gains of the two diet groups were monitored up to 12 weeks of age. The effect of genotype by diet interaction on body weight and weight gain was not significant ($p>0.05$) throughout the period. Birds on broiler diet regime were significantly ($p<0.01$) heavier at 8 and 12 weeks of age compared with those on layer type diets. The effect of genotype on bodyweight was significant throughout the 12 week period and significant in weight gain at the periods of 0-4 weeks and 4-8 weeks of age only. During these periods, the F_1 reciprocal crossbred groups (G_2 and G_3) compared favourably with the exotic (G_4) in weight gain indicating that the local chicken could be used in crosses with the exotic birds for the production of table birds, which are adapted to the local harsh environmental conditions and which are resistant to most of the endemic diseases. (*International Journal of Poultry Science* 8 (5): 504-507, 2009; **doi:** 10.3923/ijps.2009.504.507)

Effects of Dietary Energy and Protein on Growth Performance and Carcass Quality of Broilers during Starter Phase

Zhuye Niu, Jingsong Shi, Fuzhu Liu, Xianhui Wang, Chunqi Gao and Likai Yao

A 3x4 factorial arrangement with three Metabolizable Energy (ME) levels (12.13, 12.55, 12.97 MJ/kg) and four Crude Protein (CP) levels (20.0, 21.0, 22.0 and 23.0%), respectively, was undertaken to investigate the influence of varying levels of dietary energy and protein on broiler performance and carcass quality from 1-21 days of age. Six hundred 1 day old broiler chicks were randomly divided into 12 treatments, each of which had five replicates of 10 birds. BW of 21 days of age was significantly increased with an increase in dietary ME ($p<0.05$), while not influenced by dietary CP ($p>0.05$). Both ME and CP significantly improved feed efficiency ($P<0.05$). ME significantly affected on feed intake, while CP not affected. However, there were no significant interaction in BW, average daily gain, feed intake and feed efficiency between dietary ME and CP. Higher level of dietary ME (12.97 MJ/kg) significantly increased abdominal fat percentage when compared with lower ME (12.13MJ/kg or 12.55 MJ/kg). L^* of leg meat was decreased by dietary ME, while L^* of breast meat was not affected. a^* of both breast meat and leg meat was increased with increasing dietary ME and CP. b^* of leg meat was decreased by ME while b^* of breast meat was not affected. Water-holding capacity (WHC) of breast meat was decreased by dietary ME, while increased by dietary CP. The results of present research indicated that the optimal dietary ME requirement of broilers from 1-21 days of age is 12.97 MJ/kg and the CP requirement is 21-22%. (*International Journal of Poultry Science* 8 (5): 508-511, 2009; **doi:** 10.3923/ijps.2009.508.511)

Evaluation of Experimental Vaccination in Chinese Goose (*Anser cygnoides*) Against Newcastle Disease: Investigation of the State of Virus Carrier

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This study aimed the characterization of the importance of vaccination against Newcastle disease in Chinese geese (*Anser cygnoides*) and to investigate the state of carrier of the virus in this species. There were used 120 Chinese geese, distributed at random into 4 groups, vaccinated or not. At 60 days of age, all groups were challenged with a pathogenic virus (NDV) suspension, $EID_{50} = 10^{8.15}/0.1$ mL and a group of Specific Pathogen Free (SPF) chickens were used as control of the virus. Cloacal and tracheal swabs were collected after 6, 10 and 20 days post-challenge for genome viral excretion by RT-PCR (reverse transcription-polymerase chain reaction). Chinese goose of all groups did not demonstrate any signs of Newcastle disease. They were refractory to the clinical disease with the NDV. In Chinese geese from control group, NDV genome was detected 20 days after challenge. It was demonstrated therefore the state of carrier of NDV by Chinese goose. In geese, from the vaccinated groups, genome viral excretion was not detected by RT-PCR. It was also demonstrated the importance of the vaccination in the suppression of the state of carrier of NDV in Chinese geese. (*International Journal of Poultry Science* 8 (5): 512-514, 2009; *doi*: 10.3923/ijps.2009.512.514)

Evaluation of Nupro® Yeast Product in Diets for Broilers¹

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Two trials with identical experimental design were conducted approximately 20 months apart to evaluate the response of broiler chickens to the addition of NuPro®, a yeast product rich in nucleotides. In both trials, four dietary treatments were compared. The first treatment contained no NuPro®. For the second treatment, the diet with 2% NuPro® was fed only the first 7 days of life while for the third treatment, 2% NuPro® was fed for the first 14 d. For the fourth treatment, 2% NuPro® was fed for the first 7 days and also during the finisher period of 35-42 d of age. In both studies, each treatment was fed to six replicate

groups of 60 male broilers of a commercial strain. Response to the addition of NuPro® varied between the two experiments. In the first study, addition of 2% NuPro® to the diet resulted in improvement in feed conversion. Response varied by age of bird and time during which the NuPro® was fed. At 7 d of age, there were no significant differences between birds that had been fed NuPro® and those fed the negative control diet. At 14 d of age, there were no significant differences in feed conversion among birds fed the various treatments, but feed conversion was numerically better for those birds that had been fed NuPro® for the first 7 or 14 d. At 35 d, birds that had been fed NuPro® for the first 7 d had significantly better feed conversion than those fed the control diet with birds fed NuPro® for the first 14 d being intermediate between these two groups. At 42 d, birds fed diets with 2% NuPro® for the first 7 d or for the first 7 d followed by feeding from 35-42 d had significantly lower feed conversion than those fed the control, with those fed NuPro® for the first 14 d being intermediate between these groups. However, in the second trial there was no significant effect of inclusion of NuPro on any of the parameters evaluated. There may be nutritional differences between batches of the product that influence the response of chicks. (*International Journal of Poultry Science* 8 (6): 515-520, 2009; doi: 10.3923/ijps.2009.515.520)

Nipple Drinkers for Brooding Commercial Large White Turkeys¹

S.M. Russell, J.L. Grimes and A.G. Gernat

The objective of this research was to determine the effect of using nipple drinkers during brooding on the performance of Large White turkeys. There were 6 different drinkers tested: the control and 5 nipple drinker systems. The control was the Plasson Drinker and the nipple systems tested were the Plasson Easy Start (PES), Val-Co Turkey Drinker (VC), Lubing Traditional Nipple (LTN), Lubing EasyLine™ (LEL) and Ziggity Big-Z Activator (BZ). Three experiments were conducted with turkeys brooded using the 6 drinker types. Some nipple drinker treatments were used in the rearing periods. At 20 wk, Body Weight (BW) was reduced for toms brooded to 6 wk on the LTN and brooded and reared on the VC. The use of LEL and LTN (during brooding) resulted in improved Feed Conversion (FC) at 20 wk. Trial 2-experiment 1 with hens of two strains was terminated at 3 wk because of excessive mortality from dehydration with some drinker types. In trial 2 -experiment 2, there were no poult hydration issues. The

BW of hens at 6 wk brooded on the Plasson Drinker and the VC were higher compared to the BW of hens brooded on the PES and the BZ with the BW of hens on the LEL being intermediate. The use of the LTN resulted in significantly lower hen BW compared with all other drinkers through 10 wk. By 16 wk, there were no longer differences in hen BW due to drinker type. Drinker type did not have an effect on hen FC. Nipple drinkers can be used effectively to brood turkeys with some types also being useful during the rearing period. However, poor quality, inactive, or diseased poult may be at risk for dehydration on some nipple drinker systems. (*International Journal of Poultry Science* 8 (6): 521-528, 2009; *doi*: 10.3923/ijps.2009.521.528)

Influence of Post-Peak Feed Withdrawal Rate on Egg Production by Broiler Breeders of Different Weights

R.J. Lien and J.B. Hess

Broiler breeder hens are subjected to feed withdrawal as production declines after about 30 weeks of age. This study investigated effects of fast and slow feed withdrawal rates in both high and low weight hens, since body weight influences energy needs and nutrient stores. Daily allotments accounted for weight differences between high and low weight groups while decreasing 20.2 g per hen (12.8%) from peak production to 60 weeks in the slow withdrawal treatment, and 40.4 g per hen (25.6%) in the fast withdrawal treatment. From 31-60 weeks, weight gain was greatest in slow (702 g), intermediate in high-fast (351 g), and least in the low-fast treatment (219 g). Egg production began earlier and was greater in the high than low weight treatment from 23-30 weeks, was unaffected by treatments from 31-40 weeks, was greater in the slow than fast withdrawal treatment from 41-50 weeks and was greater in the low than high weight treatment from 51-60 weeks. Total production was unaffected by weight but 4.6 eggs per hen less in the fast relative to slow withdrawal treatment. The egg weight increase from 30-60 weeks was 1.4 g less in the fast relative to slow withdrawal treatment. Feed efficiency was better in the low than high weight treatment, but only marginally reduced by the fast relative to slow withdrawal treatment. These results indicate low weight breeder hens produce similar egg numbers with greater efficiency than high weight hens. In addition, doubling the typical feed withdrawal rate limits body and egg weight increases, but since it reduces egg production it only minimally improves feed efficiency. (*International Journal of Poultry Science* 8 (6): 529-535, 2009; *doi*: 10.3923/ijps.2009.529.535)

Genetic Improvement of Local Chickens by Crossing with the Label Rouge (T55XSA51): Growth Performances and Heterosis Effects

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The study of Genetic improvement of local chickens by crossing with the Label Rouge was carried out on the Experimentation Farm of the Polytechnic School of Abomey-Calavi, from August 2007 to may 2008. At the hatching, 6 lots of chicks were made up: the lot MnFl, composed of 47 chicks resulting from the crossing between females Label Rouge and males of North ecotype; the lot MIFn, composed of 58 chicks resulting from the crossing between North females and males Label Rouge; the lot MsFl, composed of 36 chicks resulting from the crossing between Label Rouge females and males of the South ecotype; the lot of north local chickens composed of 112 chicks; the lot of South local chickens composed of 128 chicks and the lot of Label Rouge composed of 204 chicks. Label Rouge have an age-type weight significantly higher than the cross ones ($p < 0.05$) and those have also an age-type weight more significant than the local chickens ($p < 0.01$). The Label Rouge had more important feed intake than the local chickens and the crossbreeds had a feed intake intermediate between the ones of the Label Rouge and the local chickens. Among the chickens resulting from a parent of North ecotype, the hens resulting from a cock of North ecotype had a weak feed efficiency compared to the one resulting from females of North ecotype. The weight average heterosis was 21.95, 14.47 and 27.69%, respectively for the cross MnFl, MIFn and MsFl. Those of the female were 1.17; 23.2 and 4.62%, respectively for the cross MnFl, MIFn and MsFl. A negative heterosis effect was obtained for the feed intake and the feed efficiency of the various crossbreeds. (*International Journal of Poultry Science* 8 (6): 536-544, 2009; **doi**: 10.3923/ijps.2009.536.544)

Novel Method for Improving the Utilization of Corn Dried Distillers Grains with Solubles in Broiler Diets

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An experiment was conducted with broiler chicks to study the possibility of improving the utilization of Dried Distillers Grains with Solubles (DDGS) in broiler diets. A total number of 150 day-old broiler chicks were randomly assigned to five groups received, diet containing 12% corn Dried Distillers Grains with Solubles

(DDGS diet) without or with enzyme preparation (E), radish root extract (RRE, as source of peroxidase enzyme) or E plus RRE, in addition to the control diet. The addition of RRE improved numerically Body Weight (BW) at 28 days and significantly at 42 days by 3.42 and 3.11%, respectively compared to birds fed DDGS diet alone. Enzyme preparation failed to improve performance for broiler fed DDGS diet. While using DDGS diet significantly decreased plasma antioxidants capacity by 56.11% compared to control birds, addition of RRE significantly increased it by 515% compared to the birds fed DDGS diet alone. There were insignificant differences between experimental treatments in plasma cholesterol, lipids or creatinine content. The addition of RRE increased plasma phosphorus by 65.93% compared to the birds fed DDGS diet alone while the later decreased it by 6.22% compared to control diet. The control birds recorded significantly higher values of plasma uric acid compared to other treatments. It was concluded that using RRE as a source of peroxidase enzyme is a suitable feed additive for improving the utilization of DDGS. (*International Journal of Poultry Science* 8 (6): 545-552, 2009; **doi:** 10.3923/ijps.2009.545.552)

Evaluation of Some Phenotypic, Physiological and Egg Quality Traits of African Black Neck Ostrich under Arid Desert Conditions of Libya

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Twenty birds of African Black Neck Ostrich (10 of both males and females) were used in the present study in a completely randomized design to verify and evaluate the differences between males and females of ostrich in some phenotypic and physiological traits, likewise the egg quality traits were estimated under the poor desert conditions of south Libya. The main results of the present study showed that males of ostrich were taller ($p \leq 0.01$) than females (240.9 vs. 218.0 cm) and had significantly ($p \leq 0.05$) lower feather length than those of females either in tail or wing feathers. Serum albumin level was higher ($p \leq 0.05$ and 0.01) in males than females, while the reverse occurred with each of globulin, calcium and magnesium. The poor desert situations of the current study had a pronounced effect on the measurements of both internal and external egg quality. Where, all values of egg quality traits were less than those found by many investigators. Correlation coefficients among the traits that have been studied were significant ($p \leq 0.05$ and 0.01) varied between negative and positive values in some cases. The highly negative correlation was observed between male height trait and serum albumen, while the converse result was realized with serum globulin trait. (*International Journal of Poultry Science* 8 (6): 553-558, 2009; **doi:** 10.3923/ijps.2009.553.558)

Simulation Models for Estimating Optimal Vaccination Timing for Infectious Bursal Disease in Broiler Chickens in Paraguay

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This study shows the results of estimating optimal vaccination timing for infectious bursal disease in broiler chickens in Paraguay, using spreadsheet simulation models. Fourteen flocks of broiler chicks were kept under observation. Sera were collected from randomly-selected 20 chicks per flock at 1, 4 and 8 days of age, and assayed by a commercial Enzyme-linked Immunosorbent Assay (ELISA) to evaluate Maternally Derived Antibody (MDA) titres. Deterministic (an age-based estimation method called the Deventer formula) and stochastic (through inclusion of uncertainty in the parameters) models were developed with the data. In the deterministic models, all the estimated optimal vaccination timings of each flock at the three sampling time points were between 16 and 24 days of age. In the stochastic models, each of the median optimal vaccination timings was estimated later than the corresponding point-estimate timing, generated by the deterministic version. Uniformity of the MDA titre distribution in the flocks was considered in relation to the number of vaccinations required. The ELISA results provide only a rough indication, in the case of deterministic model in particular. A stochastic version of the same model, in conjunction with the use of a concept of uniformity might give a solution to the problem. (*International Journal of Poultry Science* 8 (6): 559-564, 2009; *doi*: 10.3923/ijps.2009.559.564)

Probability Mapping for *Mycoplasma gallisepticum* Risk in Backyard Chickens in Paraguay

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Poultry production is a growing industry in Paraguay, South America. The insufficient farm management methods commonly used in backyard chickens make them a potential reservoir for economically important diseases such as *Mycoplasma gallisepticum* that can influence commercial poultry operations. There are no previous studies on a survey of *Mycoplasma gallisepticum* among backyard chicken population in Paraguay. The objectives of this study were: (a) to determine the seroprevalence of *Mycoplasma gallisepticum* in backyard chickens in Paraguay and (b) to generate choropleth maps for the Standardized

Risk Ratio (SRR) for *Mycoplasma gallisepticum* in the study chickens and Poisson probabilities for the SRR, in place of using the raw seroprevalence. Paraguay is divided into 17 departments. A department-stratified random sampling was planned and conducted. The required total sample size of 1291 from a chicken population of 17 million was sufficient to produce a 95% confidence interval with a desired precision of $\pm 2.5\%$ when the estimated antibody seroprevalence was 30%. Sera were analyzed using a commercial indirect ELISA. The observed overall seroprevalence was 26%. The resulting maps for the SRR for *Mycoplasma gallisepticum* in the study chickens at department level and Poisson probabilities for the SRR were depicted. Departments with significantly high or low disease risks were confirmed. Different types of epidemiological parameters can be calculated to take account of potential risk factors. Therefore, further detailed investigations into those risk factors associated with *Mycoplasma gallisepticum* occurrence with respect to spatially epidemiological differences would be of interest. (*International Journal of Poultry Science* 8 (6): 565-569, 2009; **doi:** 10.3923/ijps.2009.565.569)

Effects of Microbial Phytase Supplementation on Mineral Composition of Tibia and Mineral Utilization in Broiler Fed Maize - Based Diets

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An experiment was conducted to determine effect of supplementing maize - based diet with different levels of microbial phytase on apparent nutrient bioavailability and tibia bone mineral of broilers. Eighty, day-old broiler were randomly allotted to five dietary treatments. The control diet contained 0 FTU/kg microbial phytase which was replaced by 200, 400, 600 and 800 FTU/kg microbial phytase of the basal feed combinations. Phytase supplementation of diet increased P, Ca, Zn, Cu and Phytate - P bioavailability significantly with 800 FTU/kg microbial phytase inclusion. No significant ($p > 0.05$) difference was observed in the calcium content ($r = 0.94$) of the tibia bone of birds fed diets 400 (38.90%), 600 (38.91%) and 800 (39.08%) FTU/kg microbial phytase. Although, the phosphorus contents of birds fed diets containing 200 FTU/kg, 400 FTU/kg and 600 FTU/kg were not significantly ($p > 0.05$) different, the copper and iron levels were however vary significantly. The result also showed a significant correlation ($r = 0.98$) between the phytase level and phytate phosphorus. (*International Journal of Poultry Science* 8 (6): 570-573, 2009; **doi:** 10.3923/ijps.2009.570.573)

Prevalence of Newcastle Disease Viruses in Wild and Captive Birds in Central Nigeria

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Newcastle disease (ND) is an acute rapidly spreading, contagious, nervous and respiratory disease of domestic and wild birds caused by the Avian Paramyxovirus 1, the Newcastle disease (ND) virus. ND is endemic in Nigeria. The reservoir status of wild and captive birds for ND virus in central Nigeria is assessed in this study. Cloacal swabs were taken from one hundred and sixty three birds caught from five Local Government Council areas of Plateau, Benue and Kaduna States in central Nigeria. A total of thirteen ND Viruses were isolated from the three States. Viz: 8 isolates from Plateau, 4 from Benue and 1 from Kaduna State. One hundred and fifty three of the birds sampled belonged to 30 avian species in 10 Orders while ten birds were unidentified. Only 7% of the species in three Orders yielded ND viruses. The 13 isolates were characterized using the Mean death time of the Minimum lethal dose (MTD/MLD); Intracerebral Pathogenicity index (ICPI) Intravenous Pathogenicity index (IVPI) and the Reverse transcriptase polymerase chain reaction (RT/PCR). The results show that 12 of the isolates were of the lentogenic strain while 1 isolate belonged to the Mesogenic strain. The implication of these findings on the poultry industry in the country is discussed. (*International Journal of Poultry Science* 8 (6): 574-578, 2009; doi: 10.3923/ijps.2009.574.578)

Relation Between the *SpvC* and *InvA* Virulence Genes and Resistance of *Salmonella enterica* Serotype Enteritidis Isolated from Avian Material

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Pathogenic bacteria possess genes responsible for virulence, that when expressed, determine not only bacterial invasion and persistence and destruction of host cells but also survival capacity under inappropriate culture conditions. This study utilized 100 samples of *Salmonella enterica* subspecies *enterica* Serotype Enteritidis (SE) isolated from avian material, detected the virulence genes *InvA* and *SpvC* by medium of Polymerase Chain Reaction (PCR) and compared them for possible expression of virulence factors for survival in hostile conditions of temperature, pH and reduced concentration of nutrients necessary for SE multiplication. Of all the samples analyzed, two presented the genes *SpvC* and *InvA*, simultaneously, with

one probable expression of them being verified in growth with pH 10.0 or temperature of 25°C. But in relation to nutrient concentration, neither sample obtained growth when seeded in medium containing 0.5% nutrient. (*International Journal of Poultry Science* 8 (6): 579-582, 2009; doi: 10.3923/ijps.2009.579.582)

Effects of Different Sources and Levels of Selenium on Performance, Thyroid Function and Antioxidant Status in Stressed Broiler Chickens

Chun Fan, Bing Yu and Daiwen Chen

The effects of adding different sources and levels of selenium on performance, thyroid function and antioxidant status in stressed broiler chickens were evaluated. Stress was induced by supplementation with 20 mg/kg Corticosterone (CORT) in basal diet. Total 144 Avian broilers were used for 2 weeks from 14 days of age, which were randomly distributed to 6 groups. One of these groups was fed with basal diets and the remaining with basal diet supplemented with CORT. Meanwhile, diets used in CORT groups were supplemented with 0, 0.1 or 0.4 mg/kg sodium selenite or yeast selenium, respectively. The results showed that dietary CORT resulted in significant suppression of growth and thyroid function, increase in creatine kinase activity and uric acid concentration in serum, indicating that CORT induced stress of broilers. In addition, the balance between pro-oxidants and antioxidants was disturbed by CORT administration, resulting in oxidative injury in the body. Supplementation of dietary selenium improved feed efficiency, promoted conversion of thyroxine (T4) to triiodothyronine (T3), minimized the changes of blood biochemical parameters; furthermore, it elevated antioxidases activities and decreased lipid peroxidation products in stressed broilers. The effects of adding 0.4 mg/kg selenium were better than 0.1 mg/kg. Although there was no significant difference between two selenium sources, it was conclude that high level of inorganic or organic selenium was able to attenuate stress and oxidative injury due to exogenous CORT administration, especially organic yeast selenium. (*International Journal of Poultry Science* 8 (6): 583-587, 2009; doi: 10.3923/ijps.2009.583.587)

Methionine Supplementation Options in Poultry

V.H. Kalbande, K. Ravikanth, S. Maini and D.S. Rekhe

Methionine is essential or limiting amino acid for poultry. An experiment was conducted to determine the comparative efficacy of DL-methionine and herbal

methionine supplement on growth and performance of broiler chickens. Three hundred commercial broiler (VenCobb) chicks were procured and randomly divided into three groups (n = 100), one control (T_0) and two treatments (T_1 and T_2). All the groups were offered standard maize-soyabean meal based ration. T_1 was offered herbal sources of methionine (Methiorep®, supplied by Ayurvet Ltd., India) @1kg/tonne of feed and T_2 was administered DL- methionine@ 1 kg/tonne of feed from 0-42 days. A significant improvement in overall growth and performance was observed in birds supplemented with methionine. This study demonstrates that herbal methionine can replace DL-methionine very efficiently when used at the rate 1 g/kg diet of commercial broiler chicken. (*International Journal of Poultry Science* 8 (6): 588-591, 2009; doi: 10.3923/ijps.2009.588.591)

Performance of Finisher Broilers Fed Wet Mash with or Without Drinking Water During Wet Season in the Tropics

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Finisher broilers were fed conventional dry and wet mash with varying amounts of water addition (1.0, 1.5, 2.0 parts of water to 1 part of feed) with and without drinking water. Feed intake was higher ($P<0.05$) in all wet-fed groups but one than birds that received the conventional dry mash. Live weight gain and carcass yield was better ($P<0.05$) in all wet-fed groups than dry mash feeding. However, feed conversion efficiency (FCE) was highest in birds that received 1 part of water to 1 part of feed with drinking water, their result is comparable to those on conventional dry mash feeding and significantly ($P<0.05$) better than other wet-fed groups. No significant ($P>0.05$) differences were observed in weights of the liver, spleen, intestine, abdominal fat, proventriculus, full-gizzard and caeca. This study recommends 1 part of water to 1 part of feed with drinking water for finisher broilers when raised on wet mash during wet season in the tropics. (*International Journal of Poultry Science* 8 (6): 592-594, 2009; doi: 10.3923/ijps.2009.592.594)

Susceptibility of Guinea Fowl (*Numida Meleagris Galeata*) to Infectious Bursal Disease Virus (IBDV)

B.I. Onyeausi, C.G. Onyeausi and C.S. Ibe

The experiment was carried out to determine whether the guinea fowls are susceptible to Infectious Bursal Disease Virus (IBDV). A total of 60 guinea fowl

keets were used for the study. They were administered the inoculum through the intraocular route. 30 guinea fowl keets served as the control group (A) while, the other 30 served as the experimentally infected group (B). The only clinical signs observed in about 10 keets were mild depression and transient loss of appetite that did not last more than 24 h. The morphometric observations also indicated that the relative weights in the two groups (A and B) showed no Significant difference ($p>0.05$) in both the Control (group A) and Infected (group B) keets. It was concluded that guinea fowls are not susceptible to IBDV but they could serve as carriers, which would spread the virus to other poultry species if reared together with them. (*International Journal of Poultry Science* 8 (6): 595-597, 2009; doi: 10.3923/ijps.2009.595.597)

Developmental Stability in Chickens Local to Warm Climate 1. Variation in Internal Organs and Bilateral Traits of Lines Selected Short-Term for Growth

Essam A. El-Gendy

This study aimed at adopting the developmental changes in the internal organs and bilateral traits of growing chickens selected five generations for increased 6-week body weight and genotyping for normal feathering (line F) or naked-necks (line N), compared to their corresponding genetic controls (lines CF and CN). Line N had the smallest weight percentages of total lungs and liver (0.54 and 2.38%) and biggest weight percentages of right and left shanks (2.46 and 2.48%). Line F had the smallest spleen weight percentage (0.20%) and tallest right and left shanks (8.50 and 8.57 cm) and widest right and left shanks (3.74 and 3.75 cm). Gizzard weight percentages of lines N and CN (3.37 and 3.55%) were significantly more than those of lines F and CF (2.74 and 3.00%). The results indicated that neither short-term selection nor *Na* allele have influenced the development of heart. *Na* allele showed variable pleiotropic effects, where the weight percentages of lungs and liver were decreased and the weight percentages of gizzard and spleen were increased. A reduction in lung and liver weight percentages characterized the naked-neck selected line, revealing an interaction between selection and *Na* allele. The pressure of short-term selection for body weight was early noticeable on the development of liver and spleen that could initiate possible metabolic disorders or susceptibility to disease infection later with the continuity of selection scheme. Short-term selection albeit boosted the bilateral shank measurements, but did not influence the bilateral developmental stability. The developmental stability characterized the bilateral characters in chickens carrying *Na* allele, suggesting a role of *Na* allele in the developmental stability of the birds pertaining the

natural heating waves. The results of correlation coefficients indicated that the bilateral asymmetries of different characters are not significantly associated. (*International Journal of Poultry Science* 8 (6): 598-602, 2009; *doi*: 10.3923/ijps.2009.598.602)

Efficiency of PUFAs Incorporation from Marine Sources in Yolk Egg's Laying Hens

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Two hundred eighty-eight 32-wk-old Hisex White laying hens were used in this research during a 10 week period, arranged in a 2 x 5 completely randomized factorial design, with three replicates of eight birds per treatment. Two groups: fish oil (OP) and Marine Algae (AM) with five DHA levels (120, 180, 240, 300 and 360 mg/100 g diet) were assigned including two control groups, birds fed corn and soybean basal diet (CON) and a diet supplemented with AM (AM420) to study the efficiency of egg yolk fatty acid enrichment. The Arachidonic Acid (AA), Linoleic (LA) and PUFAs n-6 mean values ranged, respectively, 98.71 mg, 987.70 mg and 1108.92 mg/yolk for the hens fed the CON diet and 38.87 mg, 734.22 mg and 802.79 mg/yolk for the OP360 group. The percentage of AA incorporation (% INC) in egg yolk decreased linearly with the increase of DHA levels in the diets supplemented with OP and AM, from 4.81% (CON) to 2.57% (OP360) and 3.51% (AM420). The efficiency (%) of DHA incorporation into the yolk decreased linearly with increasing of DHA levels in the diet supplemented with OP and AM, from 85.11% (OP120) and 65.28% (AM120) to 49.45% (OP360) and 34.06% (AM420). The levels of DHA in the egg yolk of birds supplemented with OP had significant increase from 22.64 mg/yolk (CON) to 187.91 mg/yolk in OP360 group. PUFAs n-3 means into the eggs were significantly ($p < 0.05$) increased when the groups CON (62.16 mg/yolk) and OP360 (218.62 mg/yolk) were compared. (*International Journal of Poultry Science* 8 (6): 603-614, 2009; *doi*: 10.3923/ijps.2009.603.614)

Associations Between Microsatellite Markers and Traits Related to Performance, Carcass and Organs in Chickens

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Associations between four microsatellite markers on chromosome 11 and five on chromosome 13 with performance, carcass and organs traits were investigated in

chickens using a least-squares approach applied to single-marker analysis. Three hundred and twenty seven F₂ chickens from the EMBRAPA broiler x layer experimental population were evaluated for 16 traits: five related to performance, five to carcass and five to organs, plus the hematocrit. Two significance thresholds were considered: $p < 0.05$ and $p < 0.0056$; the last value resulted from the application of a multiple tests analyses correction. On chromosome 11, six associations ($p < 0.05$) between the genotypes of two markers with four growth related and one carcass trait were found. On chromosome 13, six associations ($p < 0.05$) between marker genotypes and three performance traits, eight associations ($p < 0.05$) between marker genotypes and two carcass traits and eight associations ($p < 0.05$) between marker genotypes and four organs traits were detected. These associations were indications of the presence of quantitative trait loci on these chromosomes, especially on chromosome 13. In this chromosome, the strongest evidence was for body weight at 41 days of age and percentage of carcass because the p-values exceeded the multiple test threshold ($p < 0.0056$), but also for breast percentage and heart weight due to the large number of markers (four) on chromosome 13 associated with each one of these traits. These associations should be further investigated by interval mapping analyses to find QTL positions and to allow the estimation of their effects. (*International Journal of Poultry Science* 8 (7): 615-620, 2009; **doi:** 10.3923/ijps.2009.615.620)

Stress Indicators to Pre-Slaughter Transportation of Broiler Chickens Fed Diets Supplemented with a Synbiotic

K. Ghareeb and J. Böhm

There is a growing interest concerning the welfare problems associated with harvesting, transportation and pre-slaughter handling of broilers. Transportation is a multifactor process associated with a variety of stressors which may covertly reduce welfare. Plasma corticosterone is elevated following a road which is consistent with the post-transport increase of heterophil: lymphocyte ratios (H/L ratios). Plasma corticosterone was compared with H/L ratio responses to various stressors and the latter was the better indicator of stress in poultry. In the present study, stress responses were evaluated in broiler chickens fed for 5 weeks a synbiotic Biomin® IMBO (a combination of *Enterococcus faecium*), a pre-biotic (derived from chicory) and immune modulating substances (derived from sea algae), with a dose of 1 kg/ ton of the starter diets and 0.5 kg/ton of the grower diets). The birds were subjected to 80 km transport journey (90 min approximately). Heterophil (H) counts, Lymphocyte (L) counts and Heterophil to

Lymphocyte (H/L) ratios were determined immediately on arrival and at 24 h following bird's transport. The H/L ratios decreased after 24 h from arrival from transport journey by about 17 % for birds fed synbiotic BIOMIN IMBO compared with controls. However, a non significant increase in L counts and a non significant decrease in H counts and H/L ratios at 24 h following bird's transport for birds fed BIOMIN IMBO compared with controls. In conclusion, feeding of BIOMIN IMBO relatively modulates the stress indicator of transported birds and relatively enhances tolerance to stress after pre-slaughter handling and transportation. (*International Journal of Poultry Science* 8 (7): 621-625, 2009; doi: 10.3923/ijps.2009.621.625)

Genetic Improvement of Local Chickens by Crossing with the Label Rouge (T55*SA51): Carcass Characteristic, Organoleptic Qualities and Heterosis Effects

I.A.K. Youssao, M. Senou, M. Dahouda, M.T. Kpodékon, J. Djenontin, N-D. Idrissou, G.A. Bonou, U.P. Tougan, S. Ahounou, H.M. Assogba, E. Bankolé, X. Rognon and M. Tixier-Boichard

The aim of this study was to evaluate the carcass characteristic and the organoleptic qualities of Label Rouge, North and South Local Chicken and their crossbreed MnFl (females Label Rouge x males of North ecotype), MIFn (North females ecotype x males Label Rouge) and MsFl (Label Rouge females x males of the South ecotype). This study was carried out on the Experimentation Farm of the Polytechnic School of Abomey-Calavi, from August 2007 to may 2008. Ten chicken of each genotype were slaughtered at 24 weeks age. The local chickens of the North ecotype had a live weight at the slaughter significantly higher than that of the Southern ecotype and lower compared to the cross and the Label Rouge; the same tendency was observed for the noble carcass cuts. The carcass yield was similar for the six genetic types. The meats of Label Rouge chickens, the local chickens and the Cross MsFl were less tender ($p < 0.05$) than those of North chickens and the Cross containing the "North blood" (MnFl and MIFn). No significant differences were observed in other hand on the juiciness and the flavor for the six genetic types. For each type of crossing, the heterosis effect of the live weight, the hot carcass weight and the wet carcass weight had a close values. In general, the different heterosis rates of the crossing male of North ecotype x female Label was superior than those of the other crossings. (*International Journal of Poultry Science* 8 (7): 626-633, 2009; doi: 10.3923/ijps.2009.626.633)

Exogenous Estradiol: Productive and Reproductive Performance and Physiological Profile of Japanese Quail Hens

Samar A. Elnagar and Ahmed M. Abd-Elhady

Seventy two, 3 weeks old female quails were distributed among 2 treatments to study the effect of estradiol administration, on their productive and reproductive performance. Birds of the first group were intramuscularly injected at 3 weeks of age daily with 100 µg E₂/bird/day for 14 consecutive days. Birds of the second group served as control. Birds injected with E₂ from 3-5 weeks of age had a significantly higher body weight at sexual maturity and matured significantly earlier compared to control. Egg number, egg weight and egg mass had significantly increased due to E₂ injection. Ovaries and oviducts relative weight, oviducts length, magnum length were none significantly increased while, shell gland length increased significantly by 17% due to estradiol injection. Serum calcium increased significantly due to E₂ injections. This was also accompanied with significant increase in Tibia weight (22%) and calcium content (10%) in compare to the untreated females. Estradiol injections resulted in a significant increase in egg shell percent and calcium content. Data indicated a stimulated pancreatic activity, as plasma glucose decreased while liver glycogen increased due to the treatment. Plasma total lipids, cholesterol and triglycerides levels were increased by 25, 20 and 22%, respectively. Similar trend was observed with liver lipids content, which was reflected on yolk lipids content. There were no significant differences observed on egg quality due to estradiol treatment. Serum transaminases (GOT and GPT) activities increased with E₂ treatment while T₃ decreased. It can be concluded that treating immature Japanese quails daily (for 2 weeks) with E₂ can enhance their reproductive and productive functions without affecting their physiological profile or their egg quality. (*International Journal of Poultry Science* 8 (7): 634-641, 2009; *doi*: 10.3923/ijps.2009.634.641)

The Effect of Using Fennel Seeds (*Foeniculum vulgare* L.) on Productive Performance of Broiler Chickens

Abdullah A. Mohammed and Rabia J. Abbas

An experiment was conducted at the College of Agriculture Poultry Farm, University of Basra from 20/11/2007 to 2/1/2008 to study the effect of adding fennel seeds to the diet on productive performance of broiler chickens. A total of 120 day - old chicks were randomly distributed into four dietary treatments of fennel 0, 1, 2 and 3 g/kg diet contained 36% and 32% chick peas in the starter

and finisher diets respectively. Results indicated that there was a significant improvement ($p<0.05$) in final body weight and feed efficiency. Carcass characteristics had no significant differences except true stomach and pancreas weight percentage. Flier repletion was highly significant when fennel was added. However chicks fed 1, 2 and 3 g/kg fennel had significantly ($p<0.05$) higher red blood cells, hemoglobin and packed cell volume. Hetrophil to lymphocyte ratio was significantly ($p<0.05$) declined for the chicks received 2 and 3g/kg fennel. (*International Journal of Poultry Science* 8 (7): 642-644, 2009; doi: 10.3923/ijps.2009.642.644)

Improving the Microbial Quality and Shelf Life of Chicken Carcasses by Trisodium Phosphate and Lactic Acid Dipping

Alaa Eldin Mohammed Ali Morshedy and Khalid Ibrahim Sallam

This study determined the influence of Trisodium Phosphate (TSP) and Lactic Acid (LA) dipping on the microbial load and shelf life of broiler chicken carcasses during refrigerated storage for 8 days at $2\pm1^{\circ}\text{C}$. The results indicated that both TSP (12%) and LA (2%) dipping significantly reduced the initial microbial load of Aerobic Plate Counts (APC), Psychrotrophic Counts (PTC), Total Proteolytic Counts (PLC) and *Enterobacteriaceae* Counts (EBC) just after dipping and throughout the storage period in comparison with the control. At the beginning of storage (day 0), no significant differences in the microbial reductions were detected between TSP and LA treatments. By the day 8 of the storage, however, LA-dipping indicated a higher ($p<0.01$) mean reductions in APC, PTC and PLC than the corresponding reductions obtained by TSP-dipping. The untreated carcasses would have a refrigerated shelf life between 4 and 5 days while after chemical dipping, the shelf life extended to about 7 days in TSP-treated carcasses and 8 days in LA-treated carcasses. Therefore, both TSP and LA can be applied on poultry carcasses to reduce their microbial load and extend their shelf life during refrigerated storage. (*International Journal of Poultry Science* 8 (7): 645-650, 2009; doi: 10.3923/ijps.2009.645.650)

Expression Profile of Toll-Like Receptor mRNA in an Indigenous Aseel Breed of Chicken in India

G. Dhinakar Raj, T.M. Chozhavel Rajanathan, K. Kumanan and S. Elankumaran

Expression profile of chicken six Toll-like Receptor (TLR) mRNAs were analyzed in the heterophils, lungs, liver, spleen, duodenum, caecal tonsils and kidneys of 12-

weeks old indigenous village chicken in India, using reverse transcription polymerase chain reaction (RT-PCR). TLR 2 type 1 mRNA was expressed in lungs, liver, spleen, duodenum and caecal tonsils. TLR2 type 2 mRNA was expressed only in the lungs. TLR 3 mRNA was expressed in lungs, liver, spleen and caecal tonsils. TLR 4 mRNA was expressed only in lungs, liver and spleen. TLR 5 and TLR 7 mRNAs were expressed in all the tissues examined. With respect to tissues, heterophils and lungs expressed all the TLR mRNAs examined while kidneys expressed only TLR 5 and TLR 7 mRNAs. All the TLR amplified PCR products were partially sequenced and showed high homologies with the available chicken (commercial) TLR gene sequences. There could be a possibility of correlation between TLR mRNA expressions with higher levels of innate immunity seen in indigenous village breeds of chickens. (*International Journal of Poultry Science* 8 (7): 651-655, 2009; **doi:** 10.3923/ijps.2009.651.655)

A Survey of Chick Mortality at Hatching in three Selected Hatcheries in Jos, Central Nigeria

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A questionnaire-based survey was conducted to investigate chick mortality at hatching in three commercial hatcheries in and around Jos, central Nigeria. Mortality was defined as the sum of dead chicks, dead-in-shell embryos and culls due to various other reasons. There was a large variation in culling rates due to poor hatching. The major reasons for culling were dead-in-shell embryos, weak chicks, dead chicks, omphalitis and physical abnormalities such as incomplete feathering, weak limbs, distorted beaks and wetness. There was no significant correlation between the age of breeding flock and percentage of culls indicating that culling rate was not strongly influenced by the age of breeding flock. Although, factors contributing to poor hatching include management and incubation failures, the most probable cause of abnormalities, weak chicks and omphalitis are diseased breeder flocks or poor hygiene and sanitation in hatchery operations. Two of the hatcheries used a combination of formaldehyde and iodine for disinfection but hygiene standards were compromised due to inadequate cleaning in all three hatcheries. The poor hatch experienced in this study suggests that there is considerable room for improvement in hatchery operations particularly with regards to hygiene and sanitation. Adequate training of hatchery operators in understanding the crucial role hygiene plays in ensuring high chick quality is needed. (*International Journal of Poultry Science* 8 (7): 656-659, 2009; **doi:** 10.3923/ijps.2009.656.659)

A Retrospective Study of Egg Production, Fertility and Hatchability of Farmed Ostriches in Botswana

B.M. Dzoma and K. Motshegwa

A retrospective observational epidemiological study was conducted to study on-farm reproductive performance (egg production, fertility and hatchability) on 4 ostrich farms in Botswana. An average of 600 birds per farm and a total of 38,447 eggs were involved. The period of operation of the farms ranged from 2-11 years. Fertility ranged from 63.5-89% ($\mu = 76.3\%$), while, hatchability ranged from 39.4-83.6% ($\mu = 53.8\%$). Hatchability averaged 54.2 and 52.4% and on farms employing the male: female breeding ratio of 1: 2 and 1: 3, respectively, while, it averaged 62.9 and 65.9% on farms employing natural and artificial incubation, respectively. Egg production, fertility and hatchability were all competitive when compared to other country figures although there is still vast room for improvement. Record keeping needs to be encouraged on farms. (*International Journal of Poultry Science* 8 (7): 660-664, 2009; doi: 10.3923/ijps.2009.660.664)

Effect of Lactic Acid and Irradiation on the Shelf Stability Characteristics of Hurdle Processed Chicken Legs

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Hurdle processed chicken legs were subjected for irradiation at 1 and 2 KGy dosage levels after treatment with lactic acid (1 and 2%) to study the effect of irradiation and lactic acid on the shelf stability of the product. The products initially and during storage at 5°C were evaluated for its oxidative rancidity profile in terms of Thiobarbituric Acid Reactive Substances (TBARS), Total carbonyls and non-heme iron values. Lipid oxidation increased with reference to irradiation dosage and there was a significant difference ($p < 0.05$) between control, 1 KGy and 2 KGy samples (without lactic acid) after 6 months of storage. Incorporation of lactic acid at 2% levels significantly reduced ($p < 0.05$) the TBARS, total carbonyls and non-heme iron values. Hurdle processed chicken legs irradiated at 2KGy with 2% lactic acid exhibited good sensory attributes after 6 months of storage having an overall acceptability score of 7.84 ± 0.31 on a 9 point hedonic scale. The total fatty acid profile by gas chromatography revealed a significant reduction ($p < 0.05$) in unsaturated fatty acids in irradiated samples but saturated fatty acids remained unaffected. The values for non irradiated samples during storage did not differ significantly ($p > 0.05$). Microbiological profile of the product showed a 3 log

reduction in SPC and 2 log reduction in Yeasts and molds by employing 2KGy irradiation dosage and pathogens were also absent. (*International Journal of Poultry Science* 8 (7): 665-670, 2009; **doi:** 10.3923/ijps.2009.665.670)

Carcass Characteristics of Broilers Fed Sugarcane Press Residue with Biotechnological Agents

B.N. Suresh, B.S.V. Reddy, Manjunatha Prabhu and B.H.N. Jaishankar

An experiment was carried out to study the effect of inclusion of sun-dried Sugarcane Press Residue (SPR) as a feed ingredient with some biotechnological interventions on the carcass characteristics and gut development of broilers. Experimental diets were prepared by incorporating SPR at 0, 5 and 10 per cent and further such diets were supplemented with or without lipid utilizing agents (lipase and lecithin) or NSP degrading enzymes or together to result in a set of 12 diets. Each diet prepared for starter (0-14 days), grower (15-28 days) and finisher (29-42 days) phases was offered to triplicate groups of 10 broiler chicks each. At the termination of the experiment (42nd day), no significant ($p>0.05$) differences in dressing percentage, meat to bone ratio, abdominal fat and relative weights of different organs viz., liver, heart, gizzard, proventriculus and spleen excepting bursa ($p<0.01$) among different treatments. The main factor SPR showed significant ($p<0.01$) differences in abdominal fat (27.79, 22.60 and 19.13 g/bird or 1.81, 1.47 and 1.33% of live weight in 0, 5 and 10% SPR based groups) while the main factor biotechnological agents in relative weight of spleen, but not for other parameters. The relative length of different segments of small intestine viz., duodenum, jejunum and ileum of birds under different treatments and main factors were remained statistically ($p>0.05$) similar. Thus it was implied that the carcass characteristic of broilers remained unaffected by SPR inclusion up to 10% except abdominal fat, gizzard and proventriculus and by supplementation of some biotechnological agents except spleen. (*International Journal of Poultry Science* 8 (7): 671-676, 2009; **doi:** 10.3923/ijps.2009.671.676)

Egg Quality Traits of Layers Fed Sugarcane Press Residue with Biotechnological Agents

B.N. Suresh, B.S.V. Reddy, Manjunatha Prabhu and B.H.N. Suma

An experiment was conducted to investigate the influence of inclusion of Sugarcane Press Residue (SPR) as a feed ingredient in layer diets on the qualities of the egg. Three experimental diets were formulated by incorporating SPR at 0,

5 and 10%. Another set of nine diets were prepared by supplementing each diet with either lipid utilizing agents (lipase and lecithin) or NSP degrading enzymes or together. Each of the twelve diets was offered to triplicate groups of 4 laying birds each. The trial lasted for 84 days divided in to three periods of 28-days each. The egg quality characteristics such as egg shape index, albumen index, Haugh unit scores, yolk index and yolk colour was statistically similar ($p>0.05$) among different treatments at different stages of experiment. However, the influence of different treatment diets on egg shell thickness was significant ($p<0.01$) on 28th and 56th day of trial. No significant differences could surface at different levels of SPR and between combinations of biotechnological tools excepting for shell thickness and yolk colour. Thus the SPR can be effectively utilized as a source of Ca and P in layers. (*International Journal of Poultry Science* 8 (7): 677-683, 2009; **doi:** 10.3923/ijps.2009.677.683)

Effects of Food Restriction on Rearing Performance and Welfare of a Slow-Growing Chicken Breed: a Behavioural Approach

J-M. Larivière, M. Vandenheede and P. Leroy

The purpose of this experiment was to investigate production and welfare implications of food restriction during the rearing period of a slow-growing chicken. Ninety-four as-hatched day-old Ardennaise chicks were raised up to two weeks of age and were then allocated to two treatment groups: *Ad libitum* Feeding (AL) and a Feed Restriction Regime (FR). Body weight, food usage and viability were recorded on a weekly basis from 1-12 weeks of age. Activity and oral behaviours were measured at 8, 9, 10, 11 and 12 weeks of age. Number of birds involved in each of twelve mutually exclusive behavioural categories was recorded. Mean proportion of time spent for each activity was calculated. Significance of effects of treatment, age, time of day and their interactions were measured. At 12 weeks of age, mean body weight was 1117 g (± 189.3 g) (AL) and 1054 g (± 187.8 g) (FR). Food usage was 4.16 kg (AL) and 3.43 kg (FR) per bird. Feeding treatment had strong effects on preening ($p<0.001$), feeder directed activity, litter scratching and pecking floor ($p<0.01$) and pacing ($p<0.05$), all activity levels being higher in the FR treatment except for feeder directed activity. Age had strong effects on sitting ($p<0.001$), standing and litter scratching ($p<0.01$). Sitting ($p<0.01$) and litter scratching ($p<0.05$) varied with treatment-age interaction. (*International Journal of Poultry Science* 8 (7): 684-688, 2009; **doi:** 10.3923/ijps.2009.684.688)

Non-Invasive Methods to Predict Breast Muscle Weight in Slow-Growing Chickens

J.-M. Larivière, C. Michaux, V. Verleyen, C. Hanzen and P. Leroy

This experiment aims to compare *in vivo* breast morphometric and ultrasound measurements, as well as live body weight to predict breast meat weight in slow-growing chickens. Traits included Thoracic Circumference (TC), Chest Width (CW), Keel Length (KL) and angle (KA), Live Weight (LW), thickness of muscle determined by sonography (TM) and Breast Meat Weight (BMW). Birds were then slaughtered and total breast muscles (*Pectoralis major* and *Pectoralis minor*) were dissected and weighed. A linear model including sex effect and the different predictor measurements, as covariates, were adjusted to the data. Homogeneity test of slopes between sexes showed no difference. Means of the traits were 115.58g (± 19.72) for BMW, 1031 g (± 163.44) for LW, 68.65° (± 6.89) for KA, 26.81 cm (± 1.57) for TC, 10.40 cm (± 0.62) for KL, 4.67 cm (± 0.47) for CW and 11.52 mm (± 1.11) for TM. All traits were highly correlated to BMW: TC (0.85), LW (0.84), KL (0.81) and TM (0.79), except for KA (0.28) and CW (0.19). Finally, TC, LW, KL and TM appear to be valuable indicators for estimating BMW in slow-growing chickens but KA and CW remain poor predictors. (*International Journal of Poultry Science* 8 (7): 689-691, 2009; **doi**: 10.3923/ijps.2009.689.691)

Effect of Varying Ratios of Dietary Calcium and Phosphorus on Performance, Phytate P and Mineral Retention in Japanese Quail (*Coturnix coturnix Japonica*)

Atefeh Sheikhlar, Azhar Bin Kasim, Loh Teck Chwen and Mohd Hair Bejo

The effect of different ratios of dietary calcium (Ca) to total phosphorus (tP) on the performances and retention of minerals and phytate phosphorus (pP) by quails were studied using 600 unsexed broiler quails from 1 to 21 days of age. Treatments consist of five corn and soybean meal (CSM) based diets with variable ratios of Ca:tP (1.96, 1.81, 1.66, 1.53 and 1.39) with four replicate of 30 birds each. Diets contained 3g chromium oxide (Cr_2O_3)/kg as marker. All ratios of Ca and P had no significant effect on feed consumption of birds. There were pronounced differences ($P < 0.05$) in body weight gain of chicks among treatments at second and third week of age. Improved ($P < 0.05$) feed conversion ratio was observed at 3 wk of age. Higher ratios of Ca:tP (1.96 and 1.81) increased ($P < 0.05$) the retention of P compared to other treatments while ratio of 1.96 decreased ($P < 0.05$) the retention of Ca and phytate. In conclusion, Ca:tP ratio

of 1.81 showed positive effect on most of parameters measured in this study. (*International Journal of Poultry Science* 8 (7): 692-695, 2009; doi: 10.3923/ijps.2009.692.695)

Potential Association Between Microsatellite Markers on Chicken Chromosomes 6, 7 and 8 and Body Weight

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Selective Genotyping (SG) is a strategy used to reduce the total number of markers and animals to be genotyped in order to detect QTL in a large designed population. The objective of this study was to detect potential associations between microsatellite markers on chromosomes 6, 7 and 8 (GGA6, GGA7 and GGA8) and Body Weight at 42 days (BW42), using an F₂ population developed by crossing a broiler (TT) and a layer (CC) lines. Chickens were separated by sex and BW42 of 2,063 F₂ offsprings was adjusted for the hatch effect. Animals that presented extreme phenotypes, i.e. the 4.5% lightest and heaviest from the normal distribution curve of phenotypes were selected within dam families, comprising 170 chickens. The means and standard deviations from the lightest and heaviest groups were 801.5±93.8 g and 1,328.5±127.8 g, respectively. Fourteen parents (TT males and CC females) and the selected 170 F₂ chickens were genotyped with 25 microsatellite markers, seven on GGA6, 11 on GGA7 and seven on GGA8. Statistical analyses used the chi-square ($p < 0.25$) to test the null hypothesis (H_0) that assumed equal allele frequencies between lighter and heavier groups, indicating no association between marker and trait. On GGA6 no association was detected. On GGA7, four markers were potentially associated with BW42: *ADL0279* ($p=0.1976$), *ADL0109* ($p=0.0946$), *ADL0315* ($p=0.2343$) and *ADL0169* ($p=0.0054$). On GGA8, markers *MCW0351* ($p=0.1580$) and *ADL0154* ($p=0.1741$) were also associated. These associations indicate potential QTL regions, where QTL interval mapping studies should be conducted on these chromosomes to identify regions that control BW42. (*International Journal of Poultry Science* 8 (7): 696-699, 2009; doi: 10.3923/ijps.2009.696.699)

Relationship Between Some Serum Enzyme Activities, Liver Functions and Body Weight in Growing Local Chickens

S.F. Hassaan, S.A. Abdel-Fattah, A.E. Elsalmony and M.S.H. Hassan

An experiment was conducted to detect the relationship between some serum enzyme activities, i.e. lactate dehydrogenase (LDH) and creatine phosphokinase

(CPK) enzymes and liver functions, as well as evaluating the difference in some physiological parameters in relation to body weight in six body weight lines of Golden Montazah (GM) chickens. A total of 288 GM chickens 4-wk old were selected from 500 unsexed GM chickens and divided into six lines (three lines within each sex) heavy (HL), light (LL) and control (CL) according to their body weights. Each line was represented by 3 replicates (16 chicks each) over two generations (G_0 and G_1). Live body weight (LBW), body weight gain (BWG), mortality rates and the levels of some serum parameters, i.e. total protein (TP), triiodothyronine (T_3), LDH, CPK, aspartate aminotransferase (AST) and alanine aminotransferase (ALT) were determined at 4 WOA in G_0 and at 12 WOA in G_0 and G_1 . The results showed that the average LBW and BWG for heavy lines and males were significantly ($p < 0.01$) higher than that of light lines and females, respectively. The heavy line chicks recorded the lowest mortality rate compared to the light ones during the period from 4-12 WOA over the two generations. The HL body weight was associated generally with an increase in the serum TP, T_3 level and LDH activity and a decrease in AST, ALT and CPK activities as compared with the LL body weight. Converse trend was observed for these traits with the LL chicks. These results concluded that, it is possible to use these parameters as physiological indices to attain the goal of improving meat production and to produce a safety and healthy poultry production. (*International Journal of Poultry Science* 8 (7): 700-705, 2009; **doi:** 10.3923/ijps.2009.700.705)

***Aloe vera* in White Leghorn Layer Diet**

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Two hundred and eighty commercial layer chicks belonging to single hatch were purchased from local hatchery, wing banded, weighed and randomly allotted into four treatment groups with four replicates of ten chicks each. The chicks were reared in cages in a gable roofed, open sided house. All the chicks were provided with uniform floor, feeder and waterer space and were reared under standard management conditions throughout the experimental period. Treatment groups were T_1 - control; T_2 -0.1% *aloe vera* powder; T_3 -0.1% *aloe vera* + 0.1% *Curcuma longa* powder and T_4 -0.1% of *aloe vera* and 0.1% of probiotic powder. There was significant ($p < 0.05$) difference in hen housed egg production, feed conversion ratio and return over feed cost in one percent *aloe vera* fed group compared to other treatment groups. No significant difference was observed in feed consumption, percent hen day egg production and percent broken eggs. It can be concluded that inclusion of 0.1 percent *aloe vera* in White Leghorn diet is economical compared to its combination with turmeric and probiotic at 0.1 percent

level. (*International Journal of Poultry Science* 8 (7): 706-709, 2009; **doi:** 10.3923/ijps.2009.706.709)

Morphological Study of the Skeleton Development in Chick Embryo (*Gallus domesticus*)

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The study comprised anatomical description of skeleton development in chick embryo *Gallus domesticus* which includes the appearance of ossification center during the embryological stages (5,10,14, 18 and 21) days. It was found that some of skull bones was formed by intramembranous ossification and that other by endochondral ossification. During the hatching, the skull was undergo complete ossification and there is a symmetry between the paired bones among their shape bone started with primary ossification center. The limbs were formed by endochondral ossification. The ossification begins centrally in the cartilage and proceed in all directions. The hind limbs ossified after fore limbs and there is an ossified signs in the tarsal and carpal bones before hatching. as well as, there is an obvious increases in length of primary ossification centers in both fore and hind limbs with further development. Histologically, three types of bone cells were studied, the osteoblasts, osteocytes and osteoclasts which covered by periosteum and their roles in intramembranous and endochondral ossification. (*International Journal of Poultry Science* 8 (7): 710-714, 2009; **doi:** 10.3923/ijps.2009.710.714)