be large if the consumer's perception of risk turns out to be large or if risk mitigation strategies appear not fully effective.

**Key Words:** Mycobacterium Avium Subspecies Paratuberculosis, Crohn's Disease, Economic Analysis

**952 Tuberculosis: A re-emerging disease at the interface of domestic animals and wildlife.** M. V. Palmer*, *National Animal Disease Center, ARS, USDA*, *Ames, IA*.

In the early twentieth century there were large numbers of tuberculous cattle in many countries. An association was made between the number of *Mycobacterium bovis* infected humans and the prevalence of tuberculosis in cattle. Mandatory pasteurization of milk and advances in public health caused the prevalence of human tuberculosis due to *M. bovis* to decline dramatically in developed countries. However, in some countries eradication has been prevented by several factors not least of which is the presence of a wildlife reservoir of *M. bovis*. In Great Britain evidence suggests that *M. bovis* is endemic among badgers (*Meles meles*), and that tuberculous badgers are the source of infection for cattle. In New Zealand, brushtail possums (*Trichosurus vulpecula*), first taken to New Zealand from Australia in the mid-nineteenth century now occupy over 90% of New Zealand's land mass and serve as a source of *M. bovis* for domestic livestock. In Michigan, USA free-ranging white-tailed deer (*Odocoileus virginianus*) represent the first known reservoir of *M. bovis* in free-living wildlife in the United States. Deer to cattle transmission of *M. bovis* has been documented. Wildlife reservoirs of *M. bovis* represent a serious challenge to the eradication of *M. bovis*. The presence of wildlife reservoirs is the direct result of spill-over of *M. bovis* from domestic livestock and efforts to eradicate *M. bovis* from domestic livestock are impeded by spill-back from wildlife reservoirs. The test and slaughter policies of tuberculosis control, effectively used with domestic livestock, are insufficient in areas where wildlife reservoirs exist. Complete removal of wildlife is impractical, and often impossible. It will not be possible to eradicate *M. bovis* from livestock until transmission between wildlife and domestic animals is halted. Such an endeavor will require a collaborative effort between agricultural, wildlife, environmental and political interests.

**Key Words:** Mycobacteria, Tuberculosis, Wildlife

## Nonruminant Nutrition: Poultry Nutrition - Phosphorus and Phytase

**953 Early response of young breeder source broilers to combined xylanase-amylase-protease-phytase supplementation of a high performance feed and when both ME-available phosphorus (AP) are reduced.** E. T. Moran* and R. Lehman, *Auburn University*, *Auburn University, AL*.

Reserve body fat and calcium-phosphorus of chicks at hatch suffer when from small eggs of young breeders. Supplemental enzymes that focused on energy and AP recovery were examined as a means to relieve early inadequacies of these source broilers. Chicks (1600; 64 pens) originating from a 26 week old R X 708 flock were either directly placed (34g/bird) in litter pens or delayed 24 hours (30 g), respective of sex. Corn-soybean meal feed for next 3 weeks was crumbed and either high performance (23% CP, 1.38% lysine, 0.98% TSAA, 3.19 Kcal ME/g, 0.44% AP, 0.99% Ca) or low ME-AP (omission of 2% fat and 0.25% dicalcium phosphate for corn: 3.11 Kcal/g, 0.34% AP, 0.87% Ca) formulations were used. Crumbed feeds were either fed "as is" or supplemented "on top" to provide units/kg of xylanase, 300; amylase, 400; protease, 4000; phytase, 5000 (0.05% Avizyme 1502 + 0.01% Phyzyme XP). The enzyme mixture did not improve gain during the subsequent 3 weeks of birds given high performance feed as much as improve F/G ($P<.05$). Low ME-AP feed adverse affected live performance that was rectified by supplemental enzymes to the same level as those receiving high performance feed with enzymes ($P<.05$). Adding enzymes also reduced within pen standard deviation of body weights, regardless of feed ($P<.05$). Delayed placement decreased body weight when placed in pens and accentuated the loss in performance from low ME-AP and benefit from enzyme supplementation. Most advantages from added enzymes were exhibited similarly by both sexes, but improved F/G was more apparent with males than females. Supplementation with feed enzymes that improve recovery of energy and phosphorus was of distinct advantage to chicks derived from young breeder hens.

**Key Words:** Broiler Chick, Feed Supplement, Incubation

**954 The effects of supplemental Quantum Phytase on second cycle Hyline W-36 hens.** M. Lilburn[1] and C. Wyatt*[2], [1]*Ohio State University*, *Wooster*, [2]*Syngenta Animal Nutrition*, *Research Triangle Park, NC*.

A flock of Hyline W-36 hens was molted using the non-feed withdrawal program developed by the University of Illinois. During the molt period, all hens were fed a diet containing primarily ground corn (23%) and wheat midds (71.1%) and the hens never completely ceased production. At the onset of second cycle production, 7 replicate blocks of hens (n=4 cages per block; 2 hens per cage) were fed one of 5 diets. The diets were a positive control containing 0.50 total phosphorus (TP), a negative control diet (NC) containing 0.28% TP and the NC diet with either 200 , 400 , or 600 units of QuantumTM phytase. All hens were limit fed 95 g/hen/d. Hen-day egg production was measured over four consecutive 28-day periods and egg weight and shell weight were determined on all eggs collected on two consecutive days during the second and last 28-d production periods. Only the data from the second 28-d period will be reported. The NC diet was numerically lower in hen-day egg production during the first 28-d compared with the mean of the PC and Quantum treatments (47.9 vs. 51.0) but the variability precluded any significant treatment differences. Over the subsequent three production periods, however, hen-day production in the NC treatment was significantly lower than the PC and Quantum supplemented treatments (Pd 2, 68.5 vs 82.0; Pd 3, 67.4 vs 79.7; Pd 4, 70.2 vs 77.3). There were no significant differences between the PC and Quantum treatments during any of the four production periods. Egg weight (63.7 vs 66.4 g) and shell weight (5.89 vs 6.08 g) were both significantly lower in the NC compared with the PC and Quantum supplemented treatments. In summary, a diet containing 0.28% TP resulted in a significant reduction in both hen-day egg production, egg weight, and shell weight compared with a diet containing 0.50% TP or the NC diet supplemented with as little as 200 units of Quantum phytase.

**Key Words:** Phytase, Laying Hens, Molt

**955 Influence of dietary calcium and phytase source on broiler performance.** T. M. Parr*, M. R. Bedford, and C. L. Wyatt, *Syngenta Animal Nutrition*, *Research Triangle Park, NC*.

Previous research has shown that bird response to fungal phytases may be linked to the level of calcium in the diet relative to phosphorus. An experiment was conducted to determine the effect of incremental doses (500 and 1000 FTU/kg diet) of a coated fungal phytase (CFP) compared with similar doses of Quantum phytase (QP; an evolved E.coli-derived phytase) on bird performance to 49d, when added to diets containing different levels of calcium. A four-phase (0-18d, 19-30d, 30-39d, and 39-49d) feeding program utilized two positive control (PC) basal diets containing either high (HPC; 1.0, 1.0, 0.95, 0.90) or low (LPC; 0.90, 0.85, 0.78, 0.72) levels of Ca, respectively. The PC diets supplied all nutrients at or above NRC requirements, with the exception of Ca in the LPC treatments. The respective negative control (HNC and LNC) diets contained 0.10% less Ca than the PC. Additionally, all NC diets were reduced by 0.13% available P, 0.029% Thr, 0.018% TSAA, 0.01% Lys, and 45kcal ME. To each negative control diet, 500 or 1000 FTU/kg of either QP or CFP was added to give 12 diets in total. Each diet was fed to 11 pens of 17 birds per pen with both feed and water being offered ad libitum. At 49 days of age, both HPC and LPC-fed birds were heavier than their NC-fed counterparts. There was a significant Ca x enzyme interaction, with birds fed QP weighing more than CFP-treated birds, as well as PC-fed birds. The addition of 500 FTU/kg QP increased intake to PC levels whereas CFP-fed birds required 1000 FTU/kg phytase. Weight corrected feed conversion (WcFCR) showed a significant interaction for Ca level x dose as well as Ca level x enzyme, indicating QP was more effective in restoring FCR than was CFP at either Ca level. When feeding high Ca levels, 1000 FTU/kg of phytase was more effective, whereas at the low Ca levels, 500 FTU/kg of either phytase had a more beneficial effect. These results indicate all phytases are more effective when Ca is not over supplied in the diet, but that QP is more efficient at restoring performance than CFP whether Ca levels in the diet are high or low.

**Key Words:** Calcium, Phytase, Broiler

**956 Influence of dietary calcium and phytase source on litter moisture and mineral content.** M. R. Bedford*[1], T. Parr[1], M. E. Persia[1], A. Batal[2], and C. L. Wyatt[1], [1]*Syngenta Animal Nutrition*, *Research Triangle Park, NC*, [2]*University of Georgia*, *Athens*.

The effects of incremental doses (500 and 1000 FTU/kg diet) of a fungal phytase (FP) was compared with that of Quantum phytase (an evolved E.coli-derived phytase; QP) on litter moisture (LM) and mineral content in a 49d grow out study utilizing a four-phase (0-18d, 19-30d, 30-39d, and 39-49d) feeding program. Birds were offered a positive control, that met or exceeded all NRC requirements (HCaPC) or a reduced Ca positive control that met or exceeded NRC requirements with the exception of Ca (LCaPC). Negative controls (HCaNC and LCaNC were generated by removing 0.13% available P, 0.1% Ca, 0.029% Thr, 0.018% TSAA, 0.01% Lys, and 45 kcal ME from the respective positive control diets. To each negative control diet, 500 or 1000 FTU of either QP or FP were added to give 12 diets in total. Each diet was fed to 11 pens of 17 birds with feed and water being offered ad libitum. At approximately day 25, it became apparent that litter quality had deteriorated in many pens. Grab samples of litter were taken immediately from each of 132 pens and analysed for moisture and mineral content. The data were analysed by ANOVA and means separated by the pdiff option of the LS means procedure. Feeding the negative control diets without phytase increased LM (30%) compared with the positive control diets. Although, feeding the LCaPC resulted in similar LM to the HCaPC (31.5 v. 33.5%), feeding the LCaNC diet resulted in significantly less LM than that of the HCaNC diet (43.5 v. 49.2%). Addition of phytase reduced LM in the HCaNC diets, but never reached the level of the HCaPC. Supplementation of the LCaNC diets with 500 and 1000 FTU of QP and 1000 FTU of FP reduced LM to the level of the LCaPC. Mineral analysis of the litter, when correlated with moisture, suggested that Zn, Ca and Na were associated with high LM whereas Mn and Cl were associated with low LM. The results suggest that LM may be influenced by feeding diets adjusted for phytase inclusion. These effects may be mitigated by manipulation of dietary mineral content.

**Key Words:** Phytase, Litter Moisture, Litter Minerals

**957 A holo-analysis of trials investigating the gain and feed conversion ratio benefits of Quantum™ phytase supplementation to broilers under a variety of managerial, environmental and dietary conditions.** M. R. Bedford*, C. Murphy, and M. E. Persia, *Syngenta Animal Nutrition*, *Research Triangle Park, NC*.

Data from a total of 77 broiler trials executed over a period of 6 years in which Quantum™ phytase (QP) and several other phytase sources were employed at dosages ranging from 25 FTU/kg to 62,500 FTU/kg were collected and collated in a database that was used to construct a comprehensive multifactorial model to describe the effect of phytase on broiler gain and FCR. Management and environmental factors, dietary ingredients and nutrient contents along with enzyme type and dosage were offered in a stepwise regression analysis ($p<0.20$ in $p>0.10$ out) of the 1032 tests available. Each test represented a response to a given dose of enzyme in any particular trial. Models for gain and FCR were generated which explained 54 and 48% of the variation, respectively. Factors which significantly influenced the FCR response to phytase included the source of the phytase (QP performing significantly better then fungal phytases), sex (females responding moreso than males), and the presence of a coccidiostat (in most cases being significant and positive). Factors influencing the gain response included the age at which the experiment started (effect being greater if the trial starts at day of age), lighting (effects diminish as lighting time increases) and the duration of the trial (longer trial gives a larger effect). Responses in both gain and FCR were best described by the logarithm of the dose of the enzyme employed rather than linear or quadratic dose terms, which suggests that phytase, unlike most other enzymes and nutrients, does not pose a risk to performance if overdosed. Indeed it suggests that technologically optimum dose for performance is considerably higher than current commercial practice. The implications of the significant factors in each model need further investigation.

**Key Words:** Holo-analysis, Phytase, Broiler

**958 A novel rapid method for determining Quantum™ phytase activity levels in animal feeds.** R. Upton*, C. Wyatt, M. Yarnall, A. Bruton, and T. Parr, *Syngenta Animal Nutrition*, *Research Triangle Park, NC*.

A new phytase (Quantum Phytase™; QP) has been selected and modified to withstand a desired thermo-tolerance range through the

feed processing system while maintaining high bio-activity in the animal. One method to demonstrate thermo-tolerance is to measure the phytase activity in the feed post-pellet to determine the critical limits in temperature tolerance. The standard method to measure phytase activity in feed is the colorimetric assay which is based on the release of P and calibrated against a P standard curve. Although it is accurate and robust, this technique is laboratory based and labor intensive. The objective of this research was to develop a rapid and reliable method to accurately determine phytase activity in complete feed samples in the field. Several methods were evaluated and an ELISA based method was determined to meet the initial requirements of being quick and reliable. The new ELISA method is based on a monoclonal antibody developed directly against the intact QP protein. Multiple studies were conducted to evaluate the thermo-tolerance of this phytase and results have shown it can survive the rigors of normal feed pelleting conditions. Further studies were performed to determine that the ELISA measures the active phytase protein levels by using levels of phytase heated at different temperatures in feed. Results of this work demonstrated a significant positive correlation ($r^2$= 0.92) between the phytase activity and ELISA protein levels. These results indicate that the monoclonal is able to detect the active form of the phytase and not denatured protein. Thus, additional evaluation was completed on the ELISA method in commercial feed samples which were collected from several countries and submitted to the laboratory for activity and protein determination. Results have shown a positive linear relationship between the standard colorimetric assay and the new ELISA method ($r^2$ = 0.825). These data support the use of this new field based method to rapidly (less than 2 hrs) and reliably measure QP in feed samples at the feed mill laboratory.

**Key Words:** Phytase, ELISA, Rapid Detection

**959 The interaction between dietary electrolyte balance and microbial phytase on the performance and nutrient utilization of broiler chickens.** V. Ravindran*[1], A. J. Cowieson[2], and P. H. Selle[3], [1]*Massey University*, *Palmerston North, New Zealand*, [2]*Danisco Animal Nutrition*, *Marlborough, United Kingdom*, [3]*University of Sydney*, *Camden, Australia*.

The possible interaction between dietary electrolyte balance (DEB = Na + K + Cl meq/kg diet) and microbial phytase on the performance and nutrient utilization of broiler starters was examined in this study. A 4 x 2 factorial treatment structure was used with four levels of DEB (150, 225, 300 and 375 meq/kg diet) with two levels of phytase (0 and 500 U/kg; Phyzyme XP). Experimental diets were based on corn and soybean meal, and formulated to contain a non-phytate P level of 0.30%. The DEB levels were altered by the use of sodium bicarbonate and ammonium chloride. Each diet was offered to 6 replicates of 8 birds each from d 1 to 21. Increasing the DEB values from 150 to 300 meq/kg had no effect on weight gains ($P<0.05$) and feed per gain ($P<0.001$), but the gains were lowered and the feed per gain was increased at 375 meq/kg. Feed intake was unaffected ($P>0.05$) by DEB levels. Supplemental phytase improved the weight gains ($P<0.001$) and feed intake ($P<0.05$) at all DEB levels. Feed per gain was lowered ($P<0.05$) by phytase addition, but a tendency for DEB x phytate interaction ($P=0.06$) was also observed, indicating that the responses to phytase were affected by DEB level. The responses in feed per gain were greater at the lowest DEB level and phytase addition had no effect on feed per gain at the highest DEB level. DEB levels had no effect on the AMEn and ileal N digestibility to 300 meq/kg, but lowered ($P<0.001$) both parameters at 375 meq/kg. Phytase addition improved ($P<0.05$) the AME and N digestibility, but responses were observed only at the first three DEB levels and none at 375 meq/kg. The improvements in AME with 500 U/kg phytase addition in 150, 225 and 275 meq/kg DEB were 0.22, 0.25 and 0.16 MJ/ kg dry matter, respectively. The present data suggest that phytase responses are influenced by DEB levels.

**Key Words:** Dietary Electrolyte Balance, Phytase, Broiler Chickens

**960 Energetic implications of endogenous amino acid flow at the terminal ileum of broilers as influenced by phytate and phytase.** A. J. Cowieson*[1] and V. Ravindran[2], [1]*Danisco Animal Nutrition*, *Marlborough, United Kingdom*, [2]*Massey University*, *Palmerston North, New Zealand*.

The enzyme-hydrolyzed casein (EHC) method was employed to determine the effect of the ingestion of different concentrations of phytic acid, without or with microbial phytase, on the flow and composition of endogenous protein at the terminal ileum of broiler chickens. Phytic acid (fed as the sodium salt) was included in a dextrose-EHC based synthetic diet at 0.85, 1.15 and 1.45 % (or 0.24, 0.32 and 0.40% phytate-phosphorus) and each diet was fed without or with an Escherichia coli-derived microbial phytase (Phyzyme XP) at 500 FTU/kg diet. A control diet containing no phytic acid was also fed as a comparison to estimate basal endogenous flows. Ingestion of phytic acid increased ($P<0.05$) the flow of endogenous amino acids and nitrogen by an average of 47% at the lowest phytic acid concentration and 87% at the highest. The addition of microbial phytase reduced ($P<0.05$) the inimical effects of phytic acid on endogenous amino acid flow at all dietary phytic acid concentrations. The energetic implications of the changes in endogenous amino acid flow were calculated using reported gross energy values for individual amino acids. The ingestion of phytic acid increased endogenous energy loss associated with protein flow by 44kcal/kg DM intake and supplemental phytase reduced this by around 15kcal/kg DM intake. It can be concluded that phytic acid is an antinutrient capable of increasing endogenous amino acid loss and as a consequence impairing the caloric value of the diet. Further, the reported effects of phytase on amino acid and energy retention may be partially explained via a reduction in endogenous investment.

**Key Words:** Phytic Acid, Phytase, Endogenous Energy Loss

**961 The response of chicks fed 5 corn cultivars to phytase supplementation.** G. M. Pesti*, H. M. Edwards, Jr., and R. I. Bakalli, *University of Georgia*, *Athens*.

Five hybrid “non-transgenic” identity preserved corn cultivar samples from the 2002 growing season with a variety of genetic backgrounds were obtained to test the hypothesis that variation in corn may be responsible for variation in the responses to phytase supplementation observed in broiler chickens. The cultivars were grown in 3 different locations, to provide a good geographical range. The cultivars ranged from 6.6 to 7.9 % crude protein. In both experiments chicks (10 per replicate) in battery brooders were fed corn, soybean meal and soybean oil based feeds for 16 days. In Experiment 1, 3 pens per treatment were fed each of 5 cultivars with 0.46 or 0.68% total phosphorus (tP) or 0 or 12000 FTU of phytase. There were significant phytase by cultivar

interactions for the incidence of P-deficiency rickets and % tibia ash. In Experiment 2, the cultivars giving the highest and lowest growth responses to phytase when fed 0.46% tP were fed to 4 replicate pens with 18 or 23% crude protein, 0.46 or 0.68% tP and 0 or 12000 FTU of phytase. Chicks fed the 18% protein feed grew slower and had much lower incidences of P-deficiency rickets (21 vs. 14%) and improved % tibia ash (39.4 vs. 37.8%). Again, the phytase x corn interactions for P-deficiency rickets and % tibia ash were significant, but the magnitude of the differences was very small. The corn x phytase interactions could be attributed to differences in the magnitude of p-deficiency rickets between cultivars (for instance, for two cultivars chicks had 97.2 vs. 59.2 % P-deficiency rickets when fed 0.46% tP and 0 FTU phytase). When phytase supplementation reduced both values to zero, the magnitude of the reductions was different. It is concluded that there were no large differences in the responses to phytase supplementation in the 5 corn samples tested.

**Key Words:** Broiler Chickens, Corn Cultivars, Phytase

**962 Performance and nutrient utilization in broilers fed corn-soybean based diets supplemented with coated phytase.** I. A. Emiola*[1], T. A. Woyengo[1], A. Owusu-Asiedu[2], P. H. Simmins[2], W. Guenter[1], and C. M. Nyachoti[1], [1]*University of Manitoba*, *Winnipeg, MB, Canada*, [2]*Danisco Animal Nutrition*, *Marlborough, United Kingdom*.

A study evaluated the effects of a new coating (c) on the bioefficacy and nutrient utilisation of a bacterially-derived phytase product (Phyzyme XP; 6-phytase, EC 3.1.3.26) in broilers fed corn-soybean meal-based diets. Two hundred and eighty-eight day-old Ross broiler chicks, balanced for initial bodyweight (BW), were fed one of 6 dietary treatments (6 replicate cages/diet; 8 birds/cage) to 21 days of age. Diets were formulated to be isonitrogenous and isoenergetic, and Ca and available P content in the PC and NC diet were reduced from 0.78 to 0.58% and 0.41 to 0.22%, respectively. The NC diet was fed without or with supplemental phytase as follows: uncoated (u) Phytase at 500 FTU/kg; cPhytase at 500, 600 or 700 FTU/kg feed. Titanium dioxide was used as an indigestible marker. Birds fed the PC diet had higher ($P < 0.05$) feed intake (FI), BW gain (BWG), and tibia ash than those fed the NC diet. Supplementing phytase, irrespective of coating, to the NC diet increased BWG and FI ($P < 0.05$) but had no effect on FCR ($P > 0.10$). No differences in response to the two phytases tested were detected. Increasing the level of cPhytase from 0 to 700 FTU/kg linearly increased FI ($P < 0.05$), BWG ($P < 0.001$), and tibia ash ($P < 0.004$). Compared to NC diet, apparent ileal digestibility of P improved ($P < 0.05$) by 19.4 percentage units with phytase supplementation at 500 FTU/kg. Growth performance, tibia ash content, P and Ca digestibilities were not different ($P > 0.05$) for cPhytase and uPhytase, however, better ($P < 0.05$) than chicks fed the NC diet. In conclusion, the efficacy of a new coated phytase based on chick performance and nutrient utilization was similar to that of the same phytase in uncoated form indicating that the coated phytase is effectively released in vivo.

**Key Words:** Broiler, Phytase, Coating

**963 Phytase recovery test after pelleting process in different commercial feed mills in Brazil.** J. O. B. Sorbara*[1,2], J. L. Lecznieski[1], C. Arakaki[1], and F.J. Piraces[1], [1]*DSM Nutritional Products*, *Sao Paulo, SP, Brazil*, [2]*Universidade Estadual de Maringa*, *Maringa, PR, Brazil*.

Several commercial phytase products are available today. For a long time just one phytase originate from Peniophora lycii (Ronozyme™ P 5000 CT) which had thermostable characteristics based on its advanced formulation technologies. During the year of 2006, four hundred feed samples with Ronozyme™ P 5000 (CT) were collected in twenty commercial feed mills in Brazil. All those samples was collected under the same methodology and phytase recovering test was run at DSM lab in Sao Paulo. Ten feed samples with Ronozyme™ P 5000 (CT) were collected after the normal mixing time. Samples were collected as the mash emptied from the mixer, and were collected in a manner to permit samples to be equally spread based on time to empty. Pellet samples were taken as they emptied from the cooler in a manner that spread samples over the batch for equal distribution. Temperature of the pelleted feed was determined immediately at the die, time of conditioning and the amount of Ronozyme™ P 5000 (CT) added to the feed were recorded. Based on these results we can conclude that Ronozyme™ P 5000 (CT) is a very stable phytase. In additional, it is important to monitor the phytase level in pellet feed due to be affected by several factors.

**Table 1. Phytase recovering test in 20 feed mill in Brazil**

| | Phytase Recovering (%) | Temperature (°C) | Conditioning Time (sec) |
|---|---|---|---|
| Mean | 89.8 | 79.1 | 25.7 |
| SD | 10.5 | 5.7 | 10.3 |
| CV | 11.7 | 7.2 | 40.0 |
| Min | 68.8 | 67 | 13 |
| Max | 107.2 | 90 | 45 |

**Key Words:** Enzymes, Pellet, Thermostability

**964 Influence of feed phosphates and phytase supplementation on broiler performance.** T. Mushtaq*[1], M. Sarwar[1], G. Ahmad[1,2], M. A. Mirza[1], and M. M. H. Mushtaq[1], [1]*University of Agriculture*, *Faisalabad, Pakistan*, [2]*Shamim Feed Industries*, *Bahawalpur, Pakistan*.

The study was conducted to compare dicalcium phosphate (DCP) as phosphorus (P) source with three other phosphates i.e., bone ash, bone meal and triple-super phosphate (TSP). A low DCP diet was prepared by reducing the available P by 0.10%. The low DCP diet was divided into two portions. One portion was fed as such whereas the other portion was supplemented with phytase at 500 phytase units per kg of finished feed. Each of the 6 dietary treatment was offered to 3 replicates having 500 straight-run Hubbard broiler chicks (n = 9000). The experiment diets having 2650 kcal ME/kg and 19.7% CP were offered for 35 d. The three DCP diets depressed the BW gain during 1 to 14 ($P \leq 0.001$), 1 to 21 ($P \leq 0.001$) and 1 to 28 d ($P \leq 0.012$). Feed intake was lowered by the three DCP diets during 1 to 21 ($P \leq 0.016$), 1 to 28 ($P \leq 0.021$) and 1 to 35 d ($P \leq 0.001$). The feed:gain data revealed a depression due to the three DCP diets during 1 to 21 ($P \leq 0.001$), 1

to 28 (P≤0.01) and 1 to 35 d (P≤0.031). The BW gain, feed:gain, feed intake, mortality and foot ash were unaffected when available P was reduced by 0.10% or phytase supplementation in low DCP diets. The results of the present study demonstrated bone ash, bone meal and TSP a superior source than that of DCP. Lowering of available P by 0.10% and addition of phytase in low available P diets did not affect the growth performance or foot ash of the broilers raised on low ME and CP diets.

**Key Words:** Feed Phosphates, Enzyme, Broiler

## Physiology & Endocrinology - Livestock and Poultry: Metabolic Physiology

**965 Plane of nutrition by tick burden interaction in cattle: Effect on metabolic indicators in plasma.** D. Tolleson*, G. Carstens, T. Welsh, P. Teel, O. Strey, S. Prince, K. Dean, and L. Slay, *Texas A&M University*.

Previous studies concerning the effect of external parasites on intake, performance, and metabolism in cattle utilized a single moderate quality (14% CP, 60% TDN) diet. The effects of an external parasite burden may be exacerbated in cattle grazing low quality forage. The objective of this study was to examine the interaction between plane of nutrition and a Lone Star (Amblyomma americanum) tick burden as expressed by metabolic indicators in cattle. Twenty eight growing beef steers (194 ± 3.0 kg) were randomly assigned to one of four treatments in a 2 × 2 factorial arrangement: moderate (M; 14.0 ± 1.0% CP, 60 ± 1.5% TDN) vs low (L; 7.0 ± 1.0% CP, 58 ± 1.5% TDN) plane of nutrition (PON), and control (no tick) vs tick treatment (300 pair of adult A. americanum per treated animal). Steers were individually fed M and L diets ad libitum for 35 d prior to and 21 d following the start of tick infestation (day 0), with peak tick feeding occurring on d 10 to 14. Animal weight and BCS were obtained on d -35, 0, and 21. Blood was sampled on d -7, 0, 7, 8, 9, 10, 11, 12, 13, 17 and 21. Plasma was harvested and analyzed for urea nitrogen (BUN), glucose (GLU), non-esterified fatty acids (NEFA), and beta-hydroxy-butyrate (BHBA). PON affected (P < 0.01) BUN and GLU but not (P > 0.1) BHBA and NEFA. The effect of day was significant (P < 0.01) for BUN, BHBA and NEFA but not (P > 0.1) GLU. Across PON, tick burden did not affect (P > 0.1) any constituent. A model containing BUN, GLU, and NEFA at d 12 and 21 described 54.9, 66.4, and 75.5 % of the variation in d 21 BCS, d 21 weight and d 0 to d 21 average daily gain (P < 0.01). PON but not tick burden affected metabolism of growing beef steers.

**Table 1. Effect of tick treatment and plane of nutrition on metabolic indicators in cattle (mean, SE).**

| Constituent | Tick | | Control | | Moderate | | Low | |
|---|---|---|---|---|---|---|---|---|
| BUN | 4.91 | 0.20 | 5.05 | 0.22 | 7.01 | 0.15 | 2.89 | 0.08 |
| GLU | 95.24 | 1.23 | 96.72 | 1.04 | 101.42 | 1.13 | 90.38 | 0.95 |
| BHBA | 473.39 | 15.03 | 426.49 | 12.97 | 455.37 | 14.13 | 444.36 | 14.20 |
| NEFA | 0.27 | 0.01 | 0.24 | 0.01 | 0.25 | 0.01 | 0.26 | 0.01 |
| | MT | | MC | | LT | | LC | |
| BUN | 6.83 | 0.21 | 7.19 | 0.21 | 2.97 | 0.12 | 2.82 | 0.12 |
| GLU | 102.85 | 1.25 | 100.01 | 1.87 | 87.52 | 1.71 | 93.28 | 0.68 |
| BHBA | 482.45 | 19.65 | 428.65 | 19.93 | 464.21 | 22.87 | 424.24 | 16.57 |
| NEFA (meq/l) | 0.25 | 0.01 | 0.25 | 0.01 | 0.30 | 0.02 | 0.22 | 0.01 |

**Key Words:** Tick, Plane of Nutrition, Metabolic Indicator

**966 Using serum components and ultrasound measurements at weaning to predict feedlot gain and carcass merit.** J. S. Thurlow*[1], T. L. Perkins[2], S. T. Reiter[1], A. H. Brown Jr.[1], and C. F. Rosenkrans Jr.[1], [1]*University of Arkansas*, *Fayetteville*, [2]*Missouri State University*, *Springfield*.

The objective of this study was to determine if weaning characteristics could be used to predict subsequent feedlot gain and carcass composition. The following items were collected at weaning and used as predictor variables: lactate dehydrogenase (LDH) activities, lactate, cortisol, insulin-like growth factor I (IGF-I), and prolactin concentrations and ultrasound measurements. Forty-six crossbred steers (203 ± 1.7 kg) were weaned (216 ± 2.6 d) and blood samples collected. Calves were weighed every 21 d and ADG calculated. Longissimus dorsi muscle area (REAU and REAU2), rib fat thickness (FTU and FTU2), intramuscular fat (IMFATU and IMFATU2), and rump fat (RUMP) were determined using ultrasonic measurements at weaning and at d 57 of the feedlot phase. Hot carcass weight (HCW), rib fat thickness (RF), longissimus dorsi muscle area (REA), marbling score (MARB), yield grade (YG), and quality grade (QG) were determined at harvest. Weaning FTU correlated with YG (r = 0.28; $P < 0.05$), and weaning REAU correlated with HCW and REA (r = 0.55 and 0.60; $P < 0.01$). Lactate concentrations at weaning tended ($P < 0.10$) to be negatively correlated with YG (r = -0.27). Serum activity of LDH tended ($P < 0.10$) to be negatively correlated (r = -0.25) with MARB. Serum IGF-I concentration correlated with REAU2 and FTU2 during the feedlot phase (r = 0.29 and 0.41 respectively; $P < 0.05$), and HCW, REA, and RF at harvest (r = 0.40, 0.38, and 0.39; $P < 0.01$). Serum components and ultrasound measurements at weaning did not accurately predict feedlot gain. However, weaning measurements of lactate concentration, serum LDH activity, and ultrasound measurements may be useful in predicting carcass composition.

**Key Words:** Feedlot, Carcass Composition, Ultrasound

**967 Use of infrared thermal imaging to measure changes in body temperature following lipopolysaccharide (LPS) administration in hair sheep ewes.** R. W. Godfrey*[1], R. C. Ketring[1], and S. T. Willard[2], [1]*University of the Virgin Islands, Agricultural Experiment Station*, *St. Croix, US Virgin Islands*, [2]*Mississippi State University*, *Mississippi State*.

Previous work in our lab has shown a high correlation of rectal and vaginal temperature (RT and VT, respectively) with maximum eye temperature (MAX) measured using digital infrared thermal imaging in hair sheep ewes. The objective of this study was to evaluate the relationship of VT, RT and MAX in hair sheep ewes after the administration of LPS to induce a febrile state. Rectal temperatures