

for in the total ileal outflow of amino acids and emphasizes that the outflow contains amino acids of both dietary and endogenous origins. Total ileal outflow of amino acids therefore consists of unabsorbed dietary amino acids and those of endogenous origin secreted into the gastrointestinal tract that were not absorbed prior to exit from the ileum into the ceca. Ileal outflow of amino acids of endogenous origin consists of basal outflow that is not dependent on feed ingredient composition and specific outflow, which is ingredient composition dependent. Thus, ileal digestibility values may be also expressed as standardized ileal digestibility or true ileal digestibility, which reflect the correction of the apparent ileal digestibility for basal or specific ileal outflow of amino acids, respectively. There is evidence from swine literature that standardized ileal amino acid digestibility values are more likely to be additive in mixtures of feed ingredients and research is needed for a variety of feed ingredients to confirm that this also holds in broiler chickens.

Key Words: Amino Acids, Digestibility, Ileal Flow

479 Digestible amino acid formulation of poultry feeds; practical considerations. D. J. Burnham*, *Aviagen, Inc, Huntsville, AL.*

Poultry Feed Formulation has evolved from an Art more toward a Science over the past forty years. Sound nutrition research and computing technology has developed alongside analytical techniques to allow us to refine our formulation techniques. Digestible amino

acid formulation is part of the science. Unfortunately, there is still a lot of Art since as an industry we are not yet fully utilizing the all of the Science that is available to us today. The United States Poultry Industry has up until recently been extremely fortunate with an abundant supply of high quality inexpensive ingredients. So, the pressure to make full use of the science has not been there. This does not however mean that this is the best or most profitable approach. There are a number of feed ingredients that have very variable digestibilities; these include, meat and bone meal, poultry by product meal, feather meal, distillers grains and solubles and others. Any ingredient that undergoes processing, primarily heat treatment, stands the risk of being damaged. Formulating on a total basis ignores these effects, and will vastly over value a poor ingredient or undervalue a well processed ingredient. Ingredient buyers are charged with buying ingredients at the lowest price, not the best value. In addition, the most limiting amino acids are now commercially available in synthetic form, these are 100% digestible. Evaluating their value when formulating on a total basis undervalues the value by at least 10%, as the assumption is that all other ingredients are 100% digestible. The most common reason given for not formulating on a digestible basis is that we do not have accurate digestibility values. The truth is that the values may be a few points out, but using an 85% digestibility coefficient when it is actually 87%, is a lot more accurate than assuming it is 100%. Indications are that the status quo is changing as bio-fuels compete for the same resources. The products we may have to use vary in digestibility more than current ingredients and we need to make sure we understand how to use them to optimize performance and maximize profitability of our operations.

Key Words: Digestible, Amino Acids, Poultry

Nonruminant Nutrition: Poultry Nutrition - Enzymes, Feeds, Feed Ingredients, and Manufacturing

480 Influence of prepress solvent extracted cottonseed meal supplemented with exogenous enzyme and digestible lysine on performance, digestibility, carcass and immunity responses of broilers chickens. T. Mushtaq¹, M. Sarwar¹, G. Ahmad^{1,2}, M. A. Mirza¹, and U. Noreen¹, ¹*University of Agriculture, Faisalabad, Pakistan*, ²*Shamim Feed Industries, Bahawalpur, Pakistan.*

The response of broiler chickens to 2 levels of endo-1,4- β xylanase (EC 3.2.1.8) and endo-1,3- β glucanase (EC 3.2.1.6) combination (with and without), 3 levels of digestible lysine (0.8, 0.9 and 1.0% with the applicability of ideal protein concept) and 2 levels of cottonseed meal (CSM; 20 and 30%) were evaluated in $2 \times 3 \times 2$ factorial arrangement. A total of 2448 male Hubbard broiler chicks were fed on the practical vegetable based mash diets having 2750 kcal ME/kg and 18.50% CP from 1 to 42 d of age. The supplemental enzyme had minimum 1,100 units of endo-1,4- β xylanase and 100 units of endo-1,3- β glucanase kg-1 of finished diet. The addition of CSM at 30% resulted in increased arginine to lysine ratio. The CSM at 30% depressed BW gain and mortality during 1 to 21 d and BW gain and feed:gain during 1 to 42 d. A depression in dressing and breast percentages were also observed by the addition of 30% CSM. The digestible lysine at 1.0% depressed the BW gain and lowered the mortality during 1 to 21 d whereas the BW gain and feed:gain were unaffected among the three digestible lysine levels. The antibody titers against Newcastle and infectious bursal disease viruses were improved with the increasing levels of digestible lysine. The enzyme supplementation improved the AME and

digestibility coefficient of nitrogen when it was used with 30% CSM. No effect of enzyme, lysine, CSM or their interactions was observed on serum iron, gizzard and liver weights or abdominal fat percent. In conclusion, the enzyme supplementation failed to show any improvement in performance in CSM based diets and increasing digestible lysine in such diets did not improve the growth performance and carcass characteristics probable due to high arginine contents.

Key Words: Cottonseed Meal, Enzyme, Digestible Lysine

481 Growth, carcass nutrients accretion and nutrient retention of broiler chicks receiving phytate- or polysaccharides-degrading enzymes. O. A. Olukosi¹, A. Cowieson², and O. Adeola¹, ¹*Purdue University, West Lafayette,* ²*Danisco Animal Nutrition, Marlborough, Wiltshire, UK.*

Broiler chicks were used to determine efficacy of a cocktail of xylanase, amylase and protease (XAP) or phytase for enhancing growth, carcass nutrient accretion and total tract nutrient retention. Carcass nutrient accretion from 0 to 21 d post hatch was determined using comparative slaughter technique. Thirty chickens were used as initial slaughter group. Four hundred and fifty chickens were allocated to 5 treatments in a randomized complete block design; each treatment had 6 replicate cages with 5 birds per replicate cage. The treatments were: (1) positive

control (PC) with adequate P and ME; (2) negative control (NC) marginal in P and ME; (3) NC plus phytase at 1,000 FTU/kg; (4) NC plus XAP added at 650, 1,650 and 4,000 U/kg of xylanase, amylase and protease, respectively; and (5) NC plus phytase and XAP at levels in 3 and 4, respectively. The diets were corn-soybean meal based with wheat as a source of non-starch polysaccharides. Phytase alone or combined with XAP improved ($P < 0.05$) all of the growth response criteria; XAP alone did not improve any of these response criteria; there were no phytase×XAP interaction. Phytase alone or combined with XAP improved ($P < 0.01$) carcass ash accretion. Phytase alone or combined with XAP improved ($P < 0.05$) carcass DM, fat and protein accretion, there was no phytase×XAP interaction for the nutrients accretion. Phytase improved ($P < 0.05$) ME, DM and P total tract retention; XAP improved ($P < 0.05$) Ca and tended to improve ME and total tract DM retention. There was phytase×XAP interaction ($P < 0.05$) only for P retention. Phytase combined with XAP improved ($P < 0.05$) retention of DM, P and Ca and ME above NC treatment. In conclusion, combination of phytase and XAP improved growth performance, carcass nutrients and ash accretion and total tract nutrients retention in broilers receiving corn-soybean meal diet marginally deficient in P and ME containing added wheat.

Key Words: Broilers, Carcass Composition, Enzymes

482 Nutritional evaluation of new corn distillers dried grains with solubles (DDGS) produced by the enzymatic milling (E-Mill) and elusieve processes. E. Kim*, C. Parsons, V. Singh, and R. Srinivasan, *University of Illinois, Urbana*.

Ethanol production is expected to greatly increase in the next five years and in response to this increase, new processes are being developed to maximize ethanol production from corn and to create new, more highly marketable corn distillers dried grains with or without solubles (DDGS or DDG, respectively). This current study evaluated coproducts produced from two different modified processes, the enzymatic milling (E-mill) and the Elusieve process. The E-mill process subjects the corn kernel to enzymes that hydrolyze starch and aids in removing the germ, pericarp, and endosperm prior to fermentation. The Elusieve process utilizes sieving the finished coproduct, DDGS, and then elutriating with air to remove fiber from the DDGS samples. To nutritionally evaluate the products produced from these new processes, a precision-fed rooster assay using cecectomized roosters was conducted to determine TME_n and amino acid digestibilities. When the E-mill DDG was compared to a conventionally processed DDGS, there was a large increase in protein content from 29.9 to 56.4%. The TME_n of the E-mill DDG was significantly increased by more than 10% compared to the conventional DDGS and amino acid digestibility coefficients for the E-mill DDG were significantly increased by 7 to 10 percentage units for most of the amino acids. When DDGS was subjected to the Elusieve process, the resulting DDGS had increased protein content and TME_n , particularly when high air velocities were used. The most effective Elusieve treatment increased the protein content from 29.9 to 37.2% and increased the TME_n by approximately 7%. The results of this study indicate that the Elusieve and E-Mill processes can be used to enhance the nutritional value of DDGS for poultry.

Key Words: Modified Distillers Dried Grains With Solubles, Processing Technologies, Precision-Fed Rooster Assay

483 Phytase in ethanol production process improves nutritive value of DDGS. M. Hruby*¹, J. K. Shetty², G. Chotani², T. Dodge², and C. N. Coon³, ¹Danisco, St. Louis, MO, ²Genencor, Palo Alto, CA, ³University of Arkansas, Fayetteville.

A study was conducted to evaluate the effect of phytase treatment in different ethanol production processes, i.e. conventional hot cook and Granular Starch Hydrolyzing Enzymes (GSHE) process on the nutritive value of distillers dried grains with solubles (DDGS). The samples were analyzed for dry matter, oil, starch, rate of starch digestion (RSD), crude protein, NDF, ADF, crude fiber, ash, sugar, total phosphorus and phytate phosphorus. Each DDGS sample was precision-fed to market-age broilers and total excreta collection was conducted during 48 hours after DDGS feeding. Almost no phytate P was detected in DDGS samples from the phytase-containing ethanol processes. DDGS derived from the phytase treatment had significantly higher true metabolizable energy (TME) and digestibility of some amino acids.

Key Words: Phytase, Ethanol Process, DDGS Digestibility

484 Effects of mega doses of phytase on broiler chick body composition. J. Puttress*¹, W. W. Saylor¹, R. Angel², A. D. Mitchell³, and M. E. Persia¹, ¹University of Delaware, Newark, ²University of Maryland, College Park, ³USDA, Beltsville, MD.

Phytate is found in seed-based feedstuffs and can bind, among others, Ca, trace minerals and possibly starch and protein reducing bioavailability of these nutrients. New evidence suggests that phytate has additional antinutrient properties. Phytase hydrolyzes P bound to phytate increasing phytate P utilization and reducing the antinutritional effects of phytate. An experiment was conducted to determine the effects of mega doses of phytase on body composition of chicks fed adequate nonphytate P (nPP). There were five experimental treatments including a control diet (0.45% nPP) and the same diet supplemented with 500, 7500 and 15000 FTU of OptiPhos™ (an *E. coli* phytase; EP), and 15000 FTU of Ronozyme™ (a fungal phytase; FP). Each treatment was fed to eight replicate groups of eight male Ross 308 chicks from 8 d to 22 d. On d 22, the chicks were euthanized and frozen for dual energy X-ray absorptiometry (DXA) scanning before being ground for wet chemistry body composition analysis. Ground carcass samples were lyophilized and freeze ground for crude protein, crude fat, and ash determination. Phytase supplementation did not affect DXA lean or fat tissue accumulation, but all levels of phytase increased body mineral content over the control diet (10.11 to 10.60 g/chick v. 8.74 g/chick; $P = 0.0007$). Wet chemistry analysis showed increased crude protein of carcasses from chicks supplemented with 15000 FTU of FP compared to 15000 FTU of EP (338 v. 285 g protein/chick; $P = 0.0097$). Total carcass crude fat was increased in birds fed 15000 FTU of phytase compared to all other treatments (167 and 168 v. 151 to 155 g fat/chick; $P=0.0024$). Supplementation of birds with 7500 FTU of EP resulted in increased total carcass ash compared to birds supplemented with either 500 FTU of EP or 15000 FTU of PF (53.5 g ash/chick v. 46.1 and 44.0 g ash/chick; $P = 0.0459$). Supplementation of broiler diets with mega doses of phytase can alter chick body composition of birds fed adequate dietary nPP.

Key Words: Phytase, Body Composition, DXA

485 The effect of genotype and choice-feeding on organically-reared broilers fed diets devoid of synthetic methionine. A. L. Rack*, N. P. Buchanan, J. M. Hott, S. E. Cutlip, and J. S. Moritz, *West Virginia University, Morgantown.*

In light of the impending ban on synthetic methionine in organic poultry diets, researchers have focused on finding alternative strategies to supply this amino acid. The objectives of this study were two-fold: 1) to assess performance and carcass characteristics of a slow-growing and fast-growing broiler genotype fed diets devoid of synthetic methionine and 2) to determine performance and carcass quality effect, of choice-feeding. Inclusion of fish meal and high percentages of soybean meal enabled the specific genotype methionine requirement to be met. All diets were certified organic. Slow-growing broilers (Gourmet Black) were raised from 1-83 days, and fast-growing broilers (Cobb 500) were raised from 1-54 days. One hundred fifty birds from each genotype were reared indoors during the starter period. The broilers were transferred at the end of the starter period to houses located on the West Virginia University certified organic farm. Broilers had access to pasture for at least eight hours daily, and were exposed to natural fluctuations of environmental conditions. Choice or no choice feeding management was implemented in the grower and finisher periods. Choice-feeding management was defined as providing one feeder of ground corn and one feeder of the remaining complete diet ingredients in each pen. No choice-feeding management was defined as providing two feeders of complete diet in each pen. Birds on no choice management showed higher LWG ($p \leq 0.05$) compared to choice managed birds. Slow-growing broilers had higher FCR ($p \leq 0.05$) than the fast-growing genotype. Slow-growing birds also had lower breast yield ($p \leq 0.05$), than the fast-growing genotype. The fast-growing no choice birds had higher breast yield than the choice birds of the same genotype ($p \leq 0.05$). Fast-growing genotypes were superior in performance and carcass characteristics. Choice-feeding management did not improve performance and carcass characteristics.

Key Words: Synthetic Methionine, Organic, Broilers

486 Meat meal extract as a risk factor for the development of heart failure in fast growing commercial broilers. S. Nain*, B. Laarveld, and A. A. Olkowski, *University of Saskatchewan, Saskatoon, SK, Canada.*

The etiologies of heart failure in laboratory animals and humans have been found to be associated with thermal food processing. Cooked meat contains a number of mutagenic heterocyclic amines and other compounds which have been shown to produce cardiomyocyte necrosis and myofibrillar degeneration. It is likely that heterocyclic amines also are present in broiler diets because meat meal (MM) and fish meal are commonly included after rendering at high temperature. Our objectives were to evaluate whether compounds present in MM are associated with risk of heart failure in broilers. Extract from MM was obtained by extracting commercial product with acidified methanol at a ratio 1:4 (wt/vol). The treatment and control diets were prepared by mixing the condensed MM extract or placebo (condensed extraction medium) with commercial broiler feed. A total of 238 birds were randomly allocated to two groups (control and treatment) with 3 replications

per group. The birds were housed in raised perforated floor pens in an environmentally controlled room. Feed and water were provided ad libitum. The temperature during the first 7 days was maintained at 34°C followed by a gradual decrease to a level approximately 30% lower than that set for normo-thermal brooding. Broilers fed diet spiked with MM extract showed a higher incidence ($P \leq 0.05$) of ascites (73.9%) vs the control group (62.2%). Also the incidence of sudden death syndrome tended to be numerically higher in the MM treatment group (6.7%) vs the control group (5.9%). Post mortem examination revealed that broilers fed diet containing MM extract showed a higher frequency of cardiac lesions such as ventricular dilation, valve degeneration, and pericardial effusions. The severity of the lesions was more pronounced ($P \leq 0.05$) in the group fed the diet with MM extract. We conclude that methanol soluble factors present in MM precipitate patho-physiological changes in cardiac function and cause a higher incidence of heart failure in susceptible broilers.

Key Words: Broilers, Meat Meal, Heart Failure

487 Muscle proteins recovered from trout frames: Potential pellet binding agent and source of essential amino acids. C. K. Gehring*, J. Jaczynski, and J. S. Moritz, *West Virginia University, Morgantown.*

Pelleted diets improve live weight gain and feed efficiency over mash diets when fed throughout the grower period. Optimal broiler performance is contingent upon high pellet quality; however, due to manufacturing volume, transportation and handling, pellet quality in the broiler industry is often poor. While various pellet binding agents are available, one that is also a highly available source of essential amino acids has not been identified. The objective of this study was to recover muscle proteins from trout frames and investigate their use as a protein source and potential pellet binding agent. Proteins were recovered from trout frames via the isoelectric solubilization/precipitation method and the amino acid profile of the isolated protein slurry was analyzed. Concentrations of essential amino acids following solubilization at pH 12.0 were found to be (mg/g): isoleucine (42.11), leucine (69.5), lysine (76.34), methionine (26.21), phenylalanine (35.48), threonine (38.38), tryptophan (11.00), valine (49.93), and histidine (22.61). The essential amino acids were found to be at a high concentration (45%) of total amino acids. Solubilization at acidic pH resulted in greater percent yield on a dry matter basis: percent yield was 70.92 at pH 2.5 versus 55.83 at pH 12.0. Essential amino acid content was reduced by solubilization at pH 2.5 compared to pH 12.0 by 14.54%, 12.29% and 10.76% for methionine, lysine and threonine, respectively. Thus, solubilization at pH 12.0 was determined to be optimal. Alluding to its possibility as a pellet binding agent, trout muscle protein was found to form a stable thermally-induced gel. These results indicate that recovered muscle protein from trout frames may have potential as a high quality protein source and pellet binding agent. Future research will examine the effects of trout protein slurry on pellet quality and manufacturing variables using our pilot feed mill and true amino acid digestibility will be established by precision feeding cecectomized roosters.

Key Words: Pellet Quality, Pellet Binding Agent, Essential Amino Acids

488 Effects of diet preconditioning on the true metabolizable energy of guar meal. O. Gutierrez*, A. L. Cartwright, and C. A. Bailey, *Texas A&M University, College Station.*

Several studies report adaptive physiological responses in animals fed high-fiber diets resulting in increased capacity for nutrient utilization. This study was conducted to determine whether similar adaptation occurs with respect to true metabolizable energy (TME) of guar meal (GM) in adult Leghorn roosters. Guar meal contains approximately 11% crude fiber and 18% residual gum, which is comprised of a β -1 \rightarrow 4-linked D-mannopyranose chain with α -1 \rightarrow 6-linked D-galactopyranose branches. A total of 28 roosters were subjected to an initial assay in order to establish a baseline TME for GM. A cross-over designed feeding experiment followed, in which basal diets and high-fiber diets (25% GM) were administered for a period of three weeks before subsequent bioassays were conducted. Results of this experiment indicate that birds which consumed the high-fiber diet prior to assay had a ~9% reduction in their ability to utilize energy from GM than birds fed the basal diet. Physiological responses were reversible, in that birds consuming the high-fiber diet initially reverted to increased levels of energy utilization when administered the basal diet. However, this increase in energy utilization was intermediate to baseline observations and most likely indicates that additional time is required for the complete recovery of the digestive ability of birds fed high-fiber diets.

Key Words: Diet Preconditioning, True Metabolizable Energy, Guar Meal

489 Energy, protein, and starch digestibility of pea as affected by grind size and cold pelleting in broiler chickens. S. M. Ebsim*, T. D. Warkentin, and H. L. Classen, *University of Saskatchewan, Saskatoon, SK, Canada.*

Pea is an accepted ingredient in poultry feeding but information on the impact of feed processing on its nutritional value is minimal. Therefore, a 2 x 2 factorial arrangement was used to study the impact of hammer mill screen size (3.125 mm – S; 6.25 mm – L) and feed form (mash – M; cold pelleting – P) on the rate and degree of pea nutrient utilization in broiler chickens. Pea-based (89.7% pea) were fed from 0 to 21 d of age and included acid insoluble ash as a digestibility marker. Feces were collected from d 19 to 21 for determination of apparent metabolizable energy (AME). Digesta samples were collected from the anterior and posterior of both the jejunum and ileum at 21 d of age to determine the rate of starch and protein digestibility. There were no significant interactions between treatments and therefore the results are presented as main effects. Finer grinding resulted in a higher diet AME ($P < 0.01$) than course grinding (S – 2748 kcal/kg vs L – 2537 kcal/kg) but cold pelleting had no effect on this trait. Protein and starch digestion were not affected by grind size except in the posterior ileum where the starch (70.1 vs 59.7%) and apparent protein digestibility (82.4 vs 77.1%) were increased ($P < 0.01$) by the S treatment. In contrast, cold pelleting increased the digestibility of protein in the posterior jejunum and anterior ileum ($P < 0.01$) but not in the posterior ileum. Starch digestibility was increased by cold pelleting in all portions of the intestine ($P < 0.05$) with digestibility values of 59.6% and 70.21% in the posterior ileum for mash and cold pelleting treatments, respectively. The data demonstrate that 15-22% of pea starch and 11-16% of pea

protein was digested in the ileum. In conclusion, fine grinding and cold pelleting independently affected the AME, protein, and starch digestibility of pea for broiler chickens.

Key Words: Broiler, Starch, Protein

490 Nutritional value of corn versus sorghum when ground through different screen sizes and used in diets for broiler chicks. C. Feoli*¹, J. D. Hancock¹, M. C. Herrera², G. M. Herrera², M. J. Rios², F. Vargas³, and S. C. Mason⁴, ¹*Kansas State University, Manhattan,* ²*Universidad Nacional Agraria, Managua, Nicaragua,* ³*Asociacion Nacional de Productores de Sorgo, Managua, Nicaragua,* ⁴*University of Nebraska, Lincoln.*

Seven hundred twenty 1-d-old broiler chicks (Cobb x Cobb with an average initial body weight of 43 g) were used in a 14-d growth assay to determine the nutritional value of corn (No. 2 yellow corn imported from the United States) vs sorghum grain (Pinolero-1, a locally adapted variety with white seeds). The corn and sorghum were ground through a hammermill with screens having 6.4 vs 4 mm diameter openings to yield a 2 x 2 factorial arrangement of treatments. The birds were allotted into 1.8-m x 3.4-m pens with 30 birds/pen and six pens/treatment. Feed (meal form) and water were consumed on an ad libitum basis with the diets formulated to 1.29% Lys, 0.99% Met+Cys, 1.1% Ca, and 0.49% available P. Chicks had greater ($P < 0.008$) average daily gain (ADG) when the cereal grains were ground through the smaller screen size and this effect was most pronounced for chicks fed diets with sorghum (cereal grain x screen size interaction, $P < 0.04$). There were no effects ($P > 0.20$) of grain source or screen size on average daily feed intake (ADFI) but gain to feed ratio (G:F) was markedly improved when sorghum grain was ground through the screen with smaller openings (grain source x screen size interaction, $P < 0.006$). For the diets with corn ground through 6.4 and 4 mm screens and the diets with sorghum ground through 6.4 and 4 mm screens, ADG was 31.1, 31.4, 29.2, and 31.6 g/d, ADFI was 47.4, 50.9, 49.1, and 47.7 g/d, and G:F was 0.66, 0.62, 0.59, and 0.66 g/g, respectively. In conclusion, when ground to an appropriately fine particle size, Nicaraguan sorghum grain was equal to imported corn in nutritional value for broiler chicks.

Key Words: Sorghum, Particle Size, Broilers

491 Live performance evaluation of broilers fed all vegetable corn-soy diets supplemented with an Alpha Amylase - Beta Glucanase blend. S. L. Vieira*, D. M. Freitas, J. L. Coneglian, J. E. M. Peña, and J. Berres, *Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil.*

The use of enzyme blends directed to improve nutrient and energy utilization in broiler feeds is increasing. Generally, non starch polysaccharides are preferred target substrates for exogenous enzymes. Starch, however, is not completely digested by chickens. In this study, 1,750 Cobb X Cobb 500 broiler chicks were placed in 70 floor pens, 25 per pen. All birds were fed corn-soybean meal all vegetable diets in feeding programs composed by 7 treatments and 10 replications in a Randomized Block Design. Feeds were provided from 1 to 7, 8 to 21,

22 to 35 and 35 to 40 days. A Positive Control feeding program was formulated with ME levels as follow: 2,950; 3,050; 3,100 and 3,150 kcal ME/kg. Three Negative Controls had 60, 90, and 120 kcal ME/kg graded reductions related to the Positive Control. Supplementation of the lowest energy Negative Control with 200, 300 and 400 g/Ton of an alpha amylase and beta glucanase blend (Ronozyme A - 200 kilo-Novo alpha-amylase units and 350 fungal beta-glucanase units per g) was used in the other three feeding programs. All diets had nutrients to meet or exceed NRC (1994). Body weight, feed intake and feed conversion were weekly evaluated. At the end of the study, broilers demonstrated gradual losses in their performance in parallel with the

graded reductions in feed energy. However, including the enzyme at 300 and 400 g/Ton of feed partially alleviated these negative effects. Taking the overall feed conversion in consideration, benefits of enzyme inclusion were similar to those obtained with feeding programs having 30 and 60 kcal ME/kg higher than the Negative Control, respectively for 300 and 400 g/Ton. The observation of the weekly results indicated that enzyme efficacy was mainly demonstrated after 21 days of age. Mortality was not affected by the treatments.

Key Words: Broiler, Enzyme, All Vegetable Feed

Physiology & Endocrinology - Livestock and Poultry: Role of Lipids and Fatty Acids in Regulation of Reproductive Function

492 The role of omega-3 and -6 fatty acids in regulation of reproductive function in horses. E. L. Squires*, *Colorado State University, Fort Collins.*

Semen contains high levels of polyunsaturated fatty acids (PUFA), in particular the long-chain fatty acids docosapentaenoic acid (DPA) and docohexaenoic acid (DHA). Ability of sperm to resist cold shock is related to lipid composition of the sperm membrane. Approximately 30% of stallions have sperm that do not withstand the rigors of cooling and/or freezing. Three studies have focused on the effect of DHA supplementation to stallions. Brinsko et al. (2005) used 8 stallions in a 2x2 cross-over design. Stallions served either as control or were fed a DHA-enriched product for 14 weeks. They reported a 3-fold increase in the semen levels of DHA. Although DHA supplementation had no effect on fresh semen, it did increase total, progressive and rapid motility after 48 hr of cooling and after freezing and thawing. The most dramatic response to DHA was seen in those stallions that prior to treatment had <40% motility after 24 hr of cooling. Harris et al. (2006) conducted a similar study in which 6 stallions were fed either a basal diet with no supplementation or a basal diet supplemented with 29 g of PUFA. Supplementation resulted in a 46% increase in daily sperm output at the end of the 90-day trial. Supplemented stallions also had a higher percentage of morphologically normal spermatozoa. In the third trial, conducted at Colorado State University, 10 stallions were collected daily for 8 days and the data used to establish baseline values for seminal characteristics. Stallions were assigned to either a control diet or control diet containing 270 g DHA product. There was a significant increase in the daily number of motile sperm in the ejaculate of fresh semen, as well as semen stored for 24 hr at 5°C. These combined studies demonstrated that supplementation of stallions with PUFA containing DHA resulted in improvement in sperm numbers and semen quality.

Key Words: Stallion, Omega-3 Fatty Acid, Semen

493 Addition of protected fat in ewes with different corporal condition on superovulation and conception rate. P. Molina¹, T. Sánchez¹, O. Mejía², J. Nuñez², E. García^{*3}, O. D. Montañez-Valdez⁴, J. Cordero¹, J. Peralta¹, M. E. Ortega¹, R. Nieto⁵, E. Mendoza¹, and R. Avila¹, ¹*Colegio de Postgraduados, Montecillo, Estado de México, México*, ²*Facultad de Medicina Veterinaria y Zootecnia, UNAM, Tres Marias, Municipio de Huitzilac, México*, ³*Centro Universitario de la Costa Sur de la Universidad de Guadalajara, Aulán, Jalisco, México*, ⁴*Centro Universitario del Sur de la Universidad de Guadalajara,*

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Thirty days before synchronization there were two groups of Dorset ewes in very good body condition: In T1 ewes were fed with commercial supplement and oat straw, and in T2 ewes were fed with oats straw to lower the body condition of this group and both groups received this diet for a month. Then six ewes of each group were superovulated (donors) and the rest remained as receptor ewes (T1 n=20; T2 n=16). At the beginning of the superovulation treatment dorsal fat of the ewes was measured with ultrasound and body weight was recorded. During the first 8 days of synchronization and superovulation treatment both groups received 100 g of protected fat and same diet as T1, synchronization for donors and receptors was performed by sponges of fluorogestone acetate (FGA, 40 mg) during 12 days. Receptor ewes received 200 U.I of eCG 12 h before sponges removal. Donor ewes were superovulated with decreasing doses of FSHp two days before and after sponges removal and embryos were obtained and transferred seven days later. Average weight of ewes at the beginning of estrus synchronization was 68.9 and 64.6 kg, for T1 and T2, respectively (P=0.07), while average dorsal fat was 2.5 and 1.97 mm for T1 y T2, respectively (P<0.05). At synchronized estrus ewes of T1 and T2 weighted 71.69 and 69.03 kg (P>0.05) and dorsal fat measures were 3.5 and 3.29 mm (P>0.05). All ewes from T1 (100%) showed response to superovulation, while in T2 only 66.7%. Ewes from T1 showed an average of 9.5 ± 0.85 corpus luteum, compared to T2 with 14.75 ± 2.36 (P<0.05). Number of embryos recovered for T1 was 7.17 ± 1.10 and 11.5 ± 2.36 for T2 (P=0.09). Average number of good quality embryos was 6.7 ± 0.84 for T1 and 8 ± 2.86 for T2 (P>0.05). Percentages of conception rate were 35% and 31.5%, for T1 and T2, respectively (P>0.05). Under the conditions of the present experiment was observed that ewes with lower dorsal fat, with the addition of protected fat for a short period increased ovulation rate but not gestation rate.

Key Words: FSH, Embryos, Dorset

494 Dietary omega-3 and omega-6 fatty acids and reproduction in dairy cattle. L. Badinga* and C. Caldari-Torres, *University of Florida, Gainesville.*

Fat supplementation has become a common practice in the dairy industry due to the inability of high-producing dairy cows to maintain a positive energy balance during the transition to lactation. Available