Effect of wheat inclusion and xylanase supplementation of the diet on intestinal enzyme activity, nutrient retention and performance in laying hen from 25 to 47 wks of age. S. Mirzaei, M. Zaghari, S. Aminzadeh, M. Shivaazad, M. P. Serrano, and G. G. Mateos. 1Department of Animal Science, University of Tehran, Karaj, Iran, 2Department of Animal and Marine Biotechnology, National Institute of Genetic Engineering and Biotechnology, Tehran, Iran, 3Department of Animal Science, Universidad Politécnica de Madrid, 28040 Madrid, Spain.

A trial was conducted to examine the effects of increasing levels of wheat in the diet and xylanase (ES) supplementation on nitrogen and ether extract retention, pH of the GIT, productive performance from 25 to 47 wks of age, and enzyme activity at the small intestine level. The basal diets (from 25 to 33 wks and from 33 to 47 wks) consisted of soybean meal and corn, and the wheat was introduced in the experimental diets at expenses of corn, primarily. The experiment was completely randomized with 8 treatments arranged factorially with 4 levels of wheat (0, 23, 46, and 69% that resulted in a dietary xylan content of 1.8, 2.0, 2.2, and 2.4%, respectively) and 2 levels of xylanase (none or added at the dose recommended by the supplier) Lesafrf, Marquette-lez-lille, France). Each treatment was replicated 5 times (6 hens). The inclusion of wheat in the diet did not influence average daily feed intake, egg production, or BW gain of the hens but decreased (P ≤ 0.05) egg weight and egg mass. The reduction in egg weight with increased level of wheat in the first feeding period could be due to the low linoleic acid content (LIN) of some of the wheat diets (1.3, 1.1, 1.0, and 0.8%, respectively) as well as the antinutritional effects of xylans. The ES improved egg production, egg mass, and FCR (P ≤ 0.05). Diet did not affect the pH of any of the segments of the GIT. Wheat inclusion or ES of the diet did not affect nitrogen or fat retention at 47 wk. The inclusion of wheat in the diet increased aminopeptidase activity (P ≤ 0.01) in the duodenum but not amylase or lipase activity. Enzyme supplementation did not influence enzyme activity. It is concluded that wheat with a high NSP content, supplemented with xylanase, could be used in diets for laying hens at levels of up to 69% without hindering productive performance. However, the level of linoleic acid has to be taken into account if egg weight is important when wheat is included in the diet in substitution of corn.

Key Words: intestinal enzyme activity, laying hen performance, egg weight, xylanase

Effect of wheat cultivars and enzyme supplementation on broiler chicks performance from 1 to 42 day of age. N. Saeidi, A. Karimi, G. Sadeghi, and A. Vaziri. Animal Science Department, Faculty of Agr., University of Kurdistan, Sanandaj, Kurdistan, Iran.

It has been well established that some wheat cultivar contained higher level of soluble non-starch polysaccharides which may adversely influence broiler chicks’ performance, especially when wheat inclusion level in the diet exceed birds’ tolerance level. An experiment was carried out using 3 common wheat varieties popular in Kurdistan region, Iran (known as Sardari, Zarrin and Azar) with or without enzyme preparation (0.30 g /kg of diet, Grindzyme GP 15000) on performance of broiler chicks during 1 to 42 d of age. A total of 416, one day old Ross 308 broiler chicks were randomly assigned to 8 dietary treatments, each replicated 4 times (in floor pen) in a completely randomized design (CRD) with 4 × 2 factorial arrangements. Wheat inclusion level in wheat-SBM based diets during starter and grower period was set at 62.05 and 66.47%, respectively. Corn-SBM based diet (with or without enzyme supplementation) set as control treatments. Chick’s body weight, feed intake and feed conversion ratio, after mortality adjustments, were determined in weekly intervals. At ages of 20 and 40d, 4 birds per treatment were sampled for measurement of relative weight of gastrointestinal organs and carcasses characteristics. Results showed that birds fed corn-SBM basal diet had significantly (P < 0.05) higher feed intake during 1–21d, body weight at 21d, and daily gain during 1–21d compared with birds fed with wheat-SBM based diets; however, the difference among corn and wheat based treatments disappeared during 21–42d. The results also indicated that wheat cultivar did have significant (P < 0.05) impacts on birds’ feed intake, feed conversion ratio and relative weight of different gastrointestinal organs. Results showed that addition of enzyme to the diet did not have significant (P > 0.05) influence on birds body weight; however, enzyme supplementation significantly (P < 0.05) improved feed conversion ratio and increased ileum relative weight (%). In conclusion, the results showed the wheat variety has significant effects on birds’ performance and addition of enzyme to the diet has a potential to improve feed utilization.

Key Words: broiler, corn, enzyme, performance, wheat
The protease was effective in improving the true AA digestibility of selected AA and the degree of the impact varied between AA and ingredients.

**Key Words:** amino acid digestibility, broiler, protease

505 Effects of a mono component protease on true ileal amino acid digestibility of selected ingredients for turkey poults. C. R. Angel*1, S. L. Vieira2, M. Iwaniuk1, and N. E. Ward4, 1University of Maryland, College Park, 2Universidade Federal do Rio Grande do Sul, Porto Alegre, RS, Brazil, 4DSM Nutritional Products, Parsippany, NJ.

A study was conducted to evaluate the true amino acid (TAA) digestibility of individual ingredients for turkeys in the presence or absence of a protease. Female Nicholas turkey poults were raised to 17 d of age on a common starter diet in floor pens. At 17 d of age, birds were assigned to battery pens in a completely randomized design of 12 treatments (Trt), 8 replicate pens, 6 birds per pen. A nitrogen free diet (NFD) was formulated with 0.3% TiO2 as a marker. The corn starch, treatments (Trt), 8 replicate pens, 6 birds per pen. A nitrogen free diet (NFD) was formulated with 0.3% TiO2 as a marker. The corn starch, treatments (Trt), 8 replicate pens, 6 birds per pen. A nitrogen free diet (NFD) was formulated with 0.3% TiO2 as a marker. The corn starch, treatments (Trt), 8 replicate pens, 6 birds per pen. A nitrogen free diet (NFD) was formulated with 0.3% TiO2 as a marker. The corn starch, treatments (Trt), 8 replicate pens, 6 birds per pen. A nitrogen free diet (NFD) was formulated with 0.3% TiO2 as a marker. The corn starch, treatments (Trt), 8 replicate pens, 6 birds per pen. A nitrogen free diet (NFD) was formulated with 0.3% TiO2 as a marker. The corn starch, treatments (Trt), 8 replicate pens, 6 birds per pen. A nitrogen free diet (NFD) was formulated with 0.3% TiO2 as a marker. The corn starch, treatments (Trt), 8 replicate pens, 6 birds per pen. A nitrogen free diet (NFD) was formulated with 0.3% TiO2 as a marker. The corn starch, treatments (Trt), 8 replicate pens, 6 birds per pen.
A study was conducted to evaluate the true amino acid (TAA) digestibility of individual ingredients for laying hens. Hyline W36 white leghorn hens 56 wks of age were assigned to cages in a completely randomized design of 10 treatments (Trt) with 6 replicates of 4 birds per cage. A nitrogen free diet (NFD) was formulated with 0.3% TiO2 as a marker. The corn-starch, sucrose and SolkaFlock in the NFD diet were replaced in part by the ingredients being tested such that all the protein in the diet came from the tested ingredient. Ingredients were added to achieve 20% protein for the high protein ingredients or to a maximum of 96% of the diet for the low protein ingredients. Ingredient percentages tested in the final diets were: 42% soybean meal (SBM), 40% meat and bone meal (MBM), 75% corn distiller dried grains (DDGS), and 96% bakery by-product meal (BPM). Each Trt was supplemented or not with 200 ppm of a mono component serine protease (RONOZYME ProActTM CT, 75,000 protease units/g of enzyme product). Birds were fed the diets for 4 d and euthanized by cervical dislocation and the distal half of ileal content collected, pooled by pen and freeze-dried. Data was analyzed using a 2 way ANOVA (4 feed ingredients supplemented or not with protease) and contrasts between diets were done using students T-Test. There was a main effect of protease on the TAA digestibility of Thr, Met, Cys, Lys, Arg, Ser and Val and there were protease by ingredient interactions for Cys, Lys, Ser and Val primarily associated with the more pronounced impact of protease when added to meat MBM vs in SBM and DDGS. Addition of the mono component protease to SBM improved (P < 0.05) TAA digestibility of Thr (84.1 to 90.09%) and Met (89.1 to 94.4%). For MBM, the addition of the protease improved the TAA digestibility of Thr (64.1 to 75.1%), Cys (47.1 to 59.6%), Met (79.1 to 83.8), Lys (70.2 to 81.4%), Ser (64.1 to 74.9%) and Val (71.8 to 81.6%). The addition of the protease improved the TAA digestibility of Thr, Lys, Arg, Ser, and Val for DDGS while only Thr, Met, and Lys for BPM.

Key Words: true amino acid digestibility, laying hens, protease, ingredient


Commercial feather meal (FM) production currently utilizes a combination of temperature and pressure to disrupt the highly cross-linked structure of keratin to improve digestibility and increase the bioavailability of the component amino acids. However, the high temperatures and pressures required for processing often result in reduced amino acid quality and also increases energy costs. Valkerase (VK), a thermotolerant keratinase derived from the fermentation of Bacillus licheniformis PWD-1, was examined for its utility to improve current production processes. Enzymatic production of FM was accomplished by incubating raw feathers with VK at 50–60°C for 60 min before hydrolysis with steam at 120° or 140°C for 20 min. Control samples were subjected to identical conditions in the absence of VK treatment. Two feeding trials were then conducted to compare the quality of the FM in vivo. In each feeding trial a total of 384 Ross 308 X Ross 708 FS male broiler chicks (age 1–21 d) were fed diets formulated to contain 20% crude protein (CP) and 3180 Kcal of ME/kg in a corn-soy based test diet. A total of 6 diets were utilized in this study with the positive and negative control diets containing 20% and 15% CP, respectively. In the 4 FM diets (FM120, FM120VK, FM140 and FM140VK), 5% FM CP replaced 5% CP from soybean meal. In exp. 1, pretreatment with VK (FM120VK) produced significantly better BWG than FM120 and not different than FM140 or FM140VK. In exp. 2, FM120VK was significantly better than FM120 and also not significantly different than the positive control. Cysteine content of the FM120VK was much higher than in FM140 and FM140VK (6.89% vs 5.52% and 5.32% of CP) indicating the better quality of FM processed at the lower temperature. Conclusion: Pretreatment with Valkerase significantly improves the nutritive value of FM hydrolyzed at 120°C and yields a product of higher quality than FM hydrolyzed at 140°C.

Key Words: feather meal, keratinase, protease, broilers


Allzyme SSF and Allzyme PT are naturally fermented enzyme products with activity of carbohydrase and phytase in Allzyme SSF and pentosase in Allzyme PT. A study was conducted to investigate the effect of supplementing Allzyme SSF alone or with Allzyme PT in wheat based diet on growth performance of broiler chicks. A 2 × 3 factorial dietary treatment structure was used with 2 nutrient levels (normal or low) and 3 ways of enzyme inclusion (no enzyme, + Allzyme SSF or + Allzyme SSF and Allzyme PT). A total of 384 1-d old chicks was randomly assigned to 6 dietary treatments with 8 replicate groups of 6 chicks and was raised in pullout cages in an environmentally controlled room for 21d. Chicks had free access to feed and water. The feed intake of chicks given Allzyme SSF alone or with Allzyme PT was higher (P < 0.01) than those given no enzyme control diet with normal nutrient level. The feed to gain ratio of chicks during d1–14 was decreased (P < 0.01) by supplementing Allzyme SSF and Allzyme PT in the basal diets. The reduction of dietary nutrient level decreased (P < 0.01) weight gain and increased (P < 0.01) feed to gain ratio of chicks during 1–14d and 1–21d. Dietary supplementation of Allzyme SSF alone or with Allzyme PT increased feed intake of chicks during 1–14d. Compared with control with no enzyme supplementation, supplementing Allzyme SSF increased (P < 0.01) weight gain of chicks and supplementing Allzyme SSF plus Allzyme PT further increased (P < 0.01) weight gain of chicks. The dietary supplementation of Allzyme SSF plus Allzyme PT decreased (P < 0.01) feed to gain ratio compared with control. Data from this trial indicate that supplementation of Allzyme SSF alone or with Allzyme PT in wheat based diet can improve growth performance of broiler chicks.

Key Words: broiler, performance, wheat, enzyme

511 Effects of dietary inclusion of β-D-mannanase and a cocktail NSPase separately and in combination in low energy diets on broiler performance and white meat yield. J. Klein*1, M. Williams1, B. Brown2, S. Rao3, and J. T. Lee4, 1Poultry Science Department, AgriLife Research, Texas A&M System, College Station, 2Enzyvia LLC, Sheridan, IN, 3Foster Farms, Livingston, CA.

An experiment was conducted to investigate if an additive effect on growth performance and processing yield can be achieved with the inclusion of a β-D-mannanase (Hemicell-L) and a cocktail NSPase (developmental formula of Ensperia). The experimental design included a total of 5 dietary treatments including a positive control (PC), negative control (NC) with a reduction of 130 ME/kg through-
out the experiment compared with the PC, NC supplemented with β-mannanase, NC supplemented with NSPase, and NC supplemented with β-mannanase and NSPase. Each treatment included 8 replicate pens with 28 straight-run broilers placed per treatment group (1120 total chicks placed). Dietary program consisted of a starter (0.68 kg/bird), grower (1.45 kg/bird), finisher (1.45 kg/bird), and withdrawal (remainder of grow out). Broilers were weighed and feed consumption determined on d 14, 28, 42, and 47. Following an 8 h feed withdrawal, 5 male and 5 females per replicate pen were processed, air chilled, and deboned for white meat yield determination. Body weight was reduced ($P < 0.05$) in the NC diet as compared with the PC diet on d 14 and 28. Increases ($P < 0.05$) in body weight were observed with the inclusion of the NSPase and the NSPase + β-mannanase on d 14 and with all enzyme inclusion treatments on d 28. Feed conversion (FCR) was increased ($P < 0.05$) through 28 d of age in the NC as compared with the PC. An additive effect was observed with regard to reduced FCR through 28 d of age with the combination of β-mannanase and NSPase. The NC diet yielded the lowest processing yields and all enzyme inclusion treatments increased multiple processing parameters to a level similar to the PC including WOG weight, breast weight, tender weight, and carcass yield. These data confirm that enzyme supplementation in low energy diets improve growth performance and indicate that additive effects may be observed when using multiple enzymes.

**Key Words:** enzyme, energy, broiler, performance, processing


A total of 924 male Ross 308 one-day-old broilers were used to study the efficacy of an enzyme feed additive (Axtra XAP, Danisco Animal Nutrition) containing xylanase, protease and amylase. A randomized complete design was applied using 4 experimental treatments: T1 designated as control (no added enzyme), and T2, T3 and T4, the control diet with 50, 75 and 100 g enzyme/t of feed, respectively. The experimental design was applied to 12 pens (6 pens in T4) of 22 broilers per treatment in both the starter (0–21 d) and the grower (21–42 d) phases. The experimental diets, based on wheat and soybean meal, were presented as mash, did not contain any coccidiostat or growth promoter and were fed ad libitum to the chicks. Body weight, mortality, weight gain, feed intake, feed to gain ratio, and the European Production Efficiency Factor (EPEF) were analyzed as a randomized complete design by GLM procedure of SAS. Enzyme supplementation improved feed to gain ratio from 0 to 42 d (1.85b, 1.79a, 1.78a and 1.77a g feed/g gain, for T1, T2, T3 and T4, respectively) compared with Control birds. No significant differences in growth rate, feed intake or EPEF were observed among treatments. Chickens fed the highest dose of the enzyme (T4: 100 g/t feed) ate less feed (108.9 vs 103.7 g/d; $P = 0.007$), had reduced feed conversion ratio (1.84 vs 1.77 g feed/g gain; 0.0158) and tended to have higher EPEF values (287 vs 313; $P = 0.06$) compared with Control birds. In conclusion, supplementation with this enzyme feed additive, containing xylanase, protease and amylase, improved the efficiency of feed utilization of broiler chickens.

**Key Words:** enzyme blend, performance, wheat based diets, broilers

### 513 The influence of supplemental fat and enzyme inclusion on passage rate and metabolizable energy in broiler diets. J. D. Hamberg* and A. B. Batal, University of Georgia, Athens.

Fat inclusion has been shown to decrease gut transit time, which increases the energy availability of the diet, this is known as the extra metabolic effect of fat. Enzymes, specifically xylanases and β-glucanases are available commercially to reduce gut viscosity by breaking down non-starch polysaccharides, which improves availability and absorption of nutrients. Thus, the objective of this study was to determine the effects of fat and enzyme inclusion on passage rate, apparent metabolizable energy, and true metabolizable energy. A 4 × 3 factorial study was conducted in which a standard corn, soybean meal, distillers dried grains plus solubles based diet was fed to 30 d old broilers and excreta was collected for AME determination and passage rate was measured using a TiO2 indigestible marker. True metabolizable energy was determined by crop intubating single comb white leghorn roosters using the traditional precision fed rooster assay. The experimental diets contained one of 4 levels of supplemental fat: 0, 1, 2, and 3% and one of 3 levels of enzyme: no enzyme, a xylanase at 0.2lbs/ton, and a β-glucanase at 0.2lbs/ton. Diets were formulated to meet the birds digestible amino acid requirements; however the ME of the diets varied with fat inclusion. The calculated ME of the control diet (0% fat and no enzyme) was 2,900 kcal/kg and the ME increased 84 kcal/kg for every 1% inclusion of fat. After an overnight fast 72 birds housed in collection cages were given ad libitum to one of the 12 treatment diets (6 replications per diet) for 3 h. After 3 h time each bird was fed a #3 gelatin capsule filled with 0.3 g of TiO2. Excreta was then collected from each of the 72 pens at 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 24 h post TiO2 capsule ingestion. TiO2 recovery was performed using UV spectrophotometer measuring the absorbance at 410 nm. Significant recovery of the marker appeared in the third hour after the TiO2 gelatin capsule ingestion. Diets with higher levels of supplemental fat had slower passage rates. Increased fat level also increased the AME and TME_N of the diets.

**Key Words:** broiler, fat, passage rate, AME, TME_N