



RESEARCH UPDATE

Metabolizable energy content of high protein distillers' dried grains with or without solubles for laying hens, turkey poults and broiler chicks

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Three studies were conducted to determine the ME and ME_n of co-products from ethanol plants for diets of laying hens, turkey poults and broiler chicks using the regression method. The investigated test ingredients were high protein distillers' dried grains (HP-DDG), high protein distillers' dried grains with solubles (HP-DDGS) and a freeze dried blend (FDB) of HP-DDG and condensed distillers' solubles (CDS). The test ingredients contained 59, 48, 53% CP, 1.9, 2.7, 3.6 % Fat, 42, 28, 32% NDF and 26, 16, 23% ADF for HP-DDG, HP-DDGS and FDB, respectively. In the laying hen study ME were 2499, 3271 and 2848 kcal/kg and ME_n were 2358, 3122 and 2798 kcal/kg for HP-DDG, HP-DDGS and FDB, respectively. ME and ME_n of HP-DDG was lower ($P < 0.05$) than HP-DDGS, but there was no difference in ME and ME_n between FDB and HP-DDG or HP-DDGS. In the turkey poult study the ME were 2449, 2754 and 3203 kcal/kg and ME_n were 1968, 2485 and 2799 kcal/kg for HP-DDG, HP-DDGS and FDB, respectively. In the broiler chick study the ME were 2332, 3426 and 2433 kcal/kg and ME_n were 2281, 3237 and 2569 kcal/kg for HP-DDG, HP-DDGS and FDB, respectively. In the drying process effect (HP-DDGS vs. FDB) FDB had decreased ME and ME_n in the laying hen (13 and 10%) and broiler chick (29 and 21%) studies while the turkey poult study increased (16 and 13%). Inclusion of CDS (HP-DDG vs. HP-DDGS) resulted in increased ME and ME_n by 31 and 32% in laying hens respectively, and 12 and 26 % in turkey poults respectively and 47 and 42% in broiler chicks respectively. These studies support a theory that nascent co-products of ethanol plants may be used as viable energy sources in poultry diets.

(to be presented at the International Poultry Scientific Forum, January 2011; Study funded by IN Corn)

Standardized ileal amino acid digestibility of high protein distillers' dried grains with or without solubles for laying hens, turkey poult and broiler chicks

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Three studies were conducted to determine standardized ileal digestibility (SID) of amino acids (AA) in high protein distillers' dried grains (HP-DDG), high protein distillers' dried grains with solubles (HP-DDGS) and a freeze dried blend (FDB) of HP-DDG and condensed distillers' solubles (CDS) in laying hens, turkey poult and broiler chicks. On DM basis, the test ingredients contained 60, 55, 57% CP; 1.9, 3.1, 3.9% Fat; 43, 32, 34% NDF and 27, 18, 25% ADF for HP-DDG, HP-DDGS and FDB, respectively. In the hen study, the SID of Lys was 33, 39 and 40%, SID of Met was 72, 69 and 76%, SID of Trp was 74, 82 and 81% and SID of Thr was 57, 56 and 62% for HP-DDG, HP-DDGS and FDB, respectively. Of the indispensable AA, only Met and Trp SID were significantly different between ingredients. For Met SID, HP-DDGS was lower ($P < 0.05$) than FDB, with no difference ($P > 0.05$) between HP-DDG and FDB or HP-DDGS. For Trp, HP-DDG was lower ($P < 0.05$) than HP-DDGS, with no difference ($P > 0.05$) between FDB and HP-DDG or HP-DDGS. In the poult and broiler studies, 2 replicate cages were pooled ($n=6$). The SID of Lys was 52, 63 and 58%, SID of Met was 82, 86 and 87%, SID of Trp was 71, 79 and 78% and SID of Thr was 61, 70 and 69% for HP-DDG, HP-DDGS and FDB, respectively for poults. Of the indispensable AA, Trp SID was significantly different between ingredients, with HP-DDG being lower ($P < 0.05$) than both FDB and HP-DDGS. The SID of Lys was 58, 56 and 56%, SID of Met was 83, 79 and 82%, SID of Trp was 71, 73 and 72% and SID of Thr was 64, 59 and 62% for HP-DDG, HP-DDGS and FDB, respectively for chicks. Indispensible AA SID were not significantly different between ingredients for chicks. The inclusion of CDS (HP-DDG vs. HP-DDGS) led to 3% units higher SID of total AA in poults but decreased 2 and 5% units in hens and chicks, respectively. Heat as the drying method (HP-DDGS vs. FDB) decreased total AA SID by 3, 4 and 6% units for poults, chicks and hens, respectively. (to be presented at the Midwest Animal Science Association meeting, March 2011; Study funded by IN Corn)

Effects of Corn Naturally Contaminated with Deoxynivalenol (Vomitoxin) on Broiler Performance, Intestinal Physiology and the Immune System

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An experiment was conducted to determine the impacts of different concentrations of deoxynivalenol (DON) on performance, intestinal morphology and innate immune response in broilers fed diets containing 0, 3, 6, 9, 12mg/kg of DON. At 21d of age, birds fed 12mg/kg DON had 9.6% lower BW vs birds in the control group. Dietary DON had no effect on feed intake at 21 d of age. Additionally, birds were either not injected or injected with lipopolysaccharide 24 h prior to tissue and blood collection. Dietary DON had no effect on crypt depth, but increased villus height by feeding up to 6mg/kg DON versus the control ($P=0.02$). Serum complement activity was not affected by DON whether or not they were challenged with LPS. The proportion of heterophils in whole blood decreased and the number of lymphocytes increased linearly when feeding DON in the LPS challenged birds ($P \leq 0.05$) but was unaffected when birds were not challenged with LPS. Cecal tonsil cells were cultured with *Staphylococcus aureus* or FluoSpheres® beads and phagocytic activities measured via flow cytometry. Cecal tonsil cell phagocytosis of beads was not affected by DON with or without LPS challenge. Conversely, phagocytic capacity of cecal tonsil cells to killed *S. aureus* was significantly reduced over 2.5 fold when birds were fed 12 mg/kg DON (non-LPS challenged; $P \leq 0.05$), however, there was no effect of dietary DON when birds were challenged with LPS. Overall, corn naturally-contaminated with up to 12 mg/kg DON reduced

broiler BW at 21 d of age and reduced phagocytosis of a killed *S. aureus* by cecal tonsil cells in unchallenged birds, and greatly decreased heterophil:lymphocyte ratios in LPS challenged birds.
(to be presented at the International Poultry Scientific Forum, January 2011)

cDNA cloning and expression of Mucin2 (*MUC2*) in the chicken intestine during late embryogenesis

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MUC2 encodes the gel-forming mucins that are the major component of the mucus in the gut and are crucial for host protection from pathogens. However, the full-length sequence of human *MUC2* has not been determined because the gene contains variable copies of tandem repeat (TR) cassette, which forms a large gap in the middle of the gene. In order to help determine the gene structure and potential protein function in humans, we have performed genome comparison studies with the chicken, an evolutionarily important species. Therefore, entire chicken *MUC2* (*cMUC2*) mRNA was cloned by sequencing a contig containing 76 overlapping cDNA, RT-PCR and RACE clones. The 3' and 5' ends of *cMUC2* were determined from clones (3.3k b and 1.5kb respectively) using RACE. The *cMUC2* locus lies within a genomic gap on chicken chromosome 5, and spans 56kb. The 11 kb cDNA shares 45% similarity with human *MUC2*. A 657 bp alternatively spliced variant of *cMUC2* was detected between exons 26 and 29, which encodes the Pro-Thr-Ser (PTS) domain. *cMUC2* is rich in these PTS TR (covering over 40 % of the chicken gene), which is different from that of mouse, which lacks the TR2 region, but similar to human (where >60% of the gene encodes PTS TRs). However, the arrangement in *cMUC2* is more complex than in humans. Comparing the sequence and expression of *cMUC2* with mammals suggests the chicken may represent a better model system for investigating the human mucin genes.

(to be presented at Experimental Biology-American Society of Nutrition, March 2011; Partial funding by Biomin Research Center)

ONGOING AND UPCOMING RESEARCH

Laying Hens

- Economics of amino acid digestibility of ingredients in laying hens – Midwest Poultry Consortium and amino acid suppliers

Broilers

- Impact of broiler growth rate on coping ability and feed intake behavior during an acute phase response – Collaboration with Aviagen
- Impact of zinc status during environmental and intestinal stressors. – Zinpro International.

Turkeys

- Effects of naturally contaminated corn with DON on growth and innate immune response of turkey poults.

PENDING RESEARCH

- Effect of a mild coccidial challenge on digesta passage and endogenous amino acid loss.
- Effect of probiotic on live salmonella vaccine efficacy in egg-type chicks prior to and after challenge. – Biomin Research Center

STATUS OF PAST & CURRENT STUDENTS

- **Liting (Lilly) Xu** (China) is studying the effects of mycotoxins on innate immune response, as well as innate immune challenges on broiler strain recovery post-challenge. She will be finishing her MS in January 2011 and is pursuing positions back in China.
- **Zhengyu Jiang** (China) is nearing completion of his PhD (summer 2011). His work has focused on the predominate secretory mucin (MUC2). He has found aspects of the gene that are modified by diet and disease and leads to our better understanding of how this primary barrier of the intestine works.
- **Catalina Troche** (Virginia Tech) is nearing completion of her PhD (summer/fall 2011). Her work has focused on zinc status during various stressors.
- **Mike Banks** – Mike is finishing his MS December 2010/January 2011 studying processing and solubles addition rate impacts on high-protein DDG nutrient utilization in laying hens, turkeys, and broilers. Mike is unique in that he had a previous career in finance and accounting before changing career paths. He may continue his studies towards a PhD.
- **Medani Abdallh** – was a visiting scientist from University of Khartoum in Sudan. Medani returned to Sudan late February after working on projects involving dietary and post-excretion amendments on nitrogen losses from laying hen manures. He will be returning January 2011 to begin his PhD in our lab.
- **Levy Do Vale Texeira** – was a visiting undergraduate student from University Federal de Lavras in Brazil and returned home for final examinations in October. His work at Purdue focused on food-borne pathogens with Dr Rostagno (USDA/ARS) and nutritional evaluation of DDGS sources in our laboratory. He plans on pursuing a MS degree in Brazil.
- **Yu Han (Amy) Hung** – was a visiting undergraduate student from National Taiwan University this past summer. Her work here was assisting Liting with her studies regarding DON's effects on broiler/turkey innate immunity. She returned to NTU in September.

FUTURE DATES:January

- Indiana Livestock, Forage & Grain Forum – January 28 – Indianapolis, IN http://www.indianasoybean.com/index.php?option=com_content&view=article&id=386
- International Poultry Scientific Forum/Poultry Exposition – January 24-28 – Atlanta, GA <http://www.ipe11.org/>

March

- Midwest Poultry Convention – March 15-17, St. Paul, MN <http://www.midwestpoultry.com/>

May

- Broiler/Turkey Health & Management Schools – May 9 & 10 – West Lafayette, IN
- Laying hen Health & Management Schools – May 11 & 12 – West Lafayette, IN
- Multi-state Poultry Nutrition Conference – May 24-26 – Indianapolis, IN

July

- Poultry Science Association Meetings (joint meeting with AAAP/AVMA): July 16-19; St. Louis, MO <http://www.poultryscience.org/psa11/>