Current economic conditions necessitate that energy costs be established for nutritional and nonnutritional aspects of broiler production. Effective caloric value (ECV) enables energy cost quantification by placing caloric density equivalents upon such husbandry components as lighting program, pellet quality and bird health. Among health considerations coccidiosis mediated by the protozoan Eimeria is of concern. Metabolic costs of coccidiosis include appetite suppression and malabsorption, both of which may be impacted by dietary enzyme fortification. A 3-component 42-d factorial treatment arrangement was employed with used litter to examine the impact of cocci challenge (+ Monteban) X 2 nutritional planes (low, high) X 2 enzyme fortification levels (none, fortified). The low and high nutrition planes differed by 70 kcal/kg while enzyme effects were provided by a DSM mixture (Ronozyme AX, Roxazyme G2G, ProAct). Chicks lacking protection from Eimeria and fed the low nutrition plane exhibited the worst 42 d performance (P < 0.05) with live weight reduced 9.2%, and FCR elevated by 10.3 points. The best overall performance was achieved with high nutrition + enzymes + Monteban. However, enzyme fortification was observed to especially elevate performance of the low energy group. Just as the deleterious impact of coccidiosis appears of greater significance late in the growth curve, enzyme benefits were also enhanced. At 42 d ECV was reduced (P < 0.05) by 504 kcal with cocci challenge while enzymes elevated (< 0.05) by 504 kcal with cocci challenge while enzymes elevated (P < 0.05) ECV 204 kcal averaged over cocci challenge. There is underlying value in minimizing coccidiosis consequence by fortifying rations with the aforementioned enzyme mixture. To optimize metabolizable energy utilization requires approaches that minimize energy wastage and exogenous enzymes appear to efficaciously participate in that strategy.

**Key Words:** broiler, nutrition, enzyme, coccidiosis, Eimeria

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**263 Effects of non-starch polysaccharide enzyme on growth performance of broilers fed reformulated corn distillers dried grain with solubles (DDGS) and soybean meal-based diets containing poultry fat or vegetable oil.** A. Preynat*,1, C. McIntyre,2, G. Mathis3, B. Lumpkins4, P. Dalibard, and E. Devillard5, 1Adisseo France SAS, Antony, France, 2Adisseo USA, Alpharetta, GA, 3Southern Poultry Research, Athens, GA.

This experiment was designed to investigate the effects of a multi-enzyme complex (Rovabio® Excel) containing carbohydrases (from Penicillium funiculosum) on the performance of broilers fed reformulated corn/corn DDGS/soybean meal diets containing poultry fat or vegetable oil. Two thousand 4 hundred Cobb 500 male broilers were placed in 96 floor pens from 0 to 42 d (12 treatments, 8 pens/treatment). Treatments 1–5 constituted a positive control (PC) diet meeting breed nutrient specifications, and 4 negative controls (NC1–4). Compared with PC, NC1–4 was reduced in ME (60 kcal/kg feed), and ~2% AA. NC2 to NC4 had reduced Available P (AVP) of 0.1%, 0.14% and 0.17% respectively, and 0.09%, 0.13% and 0.16% lower Ca respectively vs. both PC and NC1. Treatments 6 to 12 had similar nutrient content to NC4 but contained Buttiauxella phytase (250, 500, 1000, 2000 FTU/kg feed) or E. coli phytase (250, 500, 1000 FTU/kg). Broiler feed conversion ratio (FCR) was poorer (P < 0.05) in NC1 vs. the PC. Removing inorganic P in NC2 to NC4 reduced 42d body weight (BW) gain by 263 g and increased BW corrected FCR by up to 10 points. Addition of phytase to NC4 improved (P < 0.05) BW gain and FCR in a step-wise manner to the highest dose of each phytase. 250 FTU/kg Buttiauxella phytase, or 500 to 1000 FTU/kg E. coli phytase to NC4 was able to fully restore 21 and 42-d FCR to the same level as the P-adequate NC1 diet. Compared with the PC diet that also had higher ME and amino acids, phytase addition of ~500 FTU Buttiauxella phytase, or 1000 FTU/kg E. coli phytase was required to obtain similar 42-d FCR. Broiler performance improved further with Buttiauxella phytase to 2000 FTU/kg, resulting in heavier BW by 190 g vs. the PC (P < 0.05). In summary, both phytase sources added to diets reduced in ME, AA, Ca, and P improved broiler performance in a dose-dependent manner (P < 0.05). However, significantly less (P < 0.05) Buttiauxella vs. E. coli phytase was required to achieve similar performance responses, which suggests higher efficacy of Buttiauxella at improving dietary nutrient availability in broiler diets.

**Key Words:** broiler, phytase, phosphorus, energy, phytase dose

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**264 Comparative efficacy of Buttiauxella and E. coli phytase on growth performance in broilers.** A. Kumar*,1, R. M. Boldt1, and P. W. Plumstead2, 1School of Animal Studies, University of Queensland, Gatton, Australia, 2Danisco Animal Nutrition, Marlborough, United Kingdom.

An experiment compared 2 different phytases, Buttiauxella spp. expressed in Trichoderma reesei or commercial E. coli phytase to replace energy, amino acids (AA), and Ca + P from inorganic sources in corn/soy-based broiler diets. Male Ross broilers were placed in 96 floor pens from 0 to 42 d (12 treatments, 8 pens/treatment). Treatments 1–5 were formulated to be adequate in nutrients, enzyme, coccidiosis, and fed the low nutrition + enzymes + Monteban diet that also had higher ME and amino acids, phytase addition of ~500 FTU/kg Rovabio® Excel, supplying 1,100 visco units of endo-β-1,4-xylanase and fed diets with vegetable oil (P < 0.05). Also, reformulations significantly affected weight gain and feed conversion (P < 0.001) rate without affecting feed intake. These parameters were fully compensated by enzyme addition (P < 0.05) and there was no interaction between the effects of fat source and enzyme supplementation. These results suggest that the efficiency of multi-enzyme complex containing NSP-enzymes to reduce energy specifications of corn and corn-DDGS-based diet without performance loss, is verified on different fat sources.

**Key Words:** NSP-enzymes, broilers, formulation matrix, growth, corn-DDGS

A battery study was conducted with 576 male broilers to study the effect of an enzyme cocktail of xylanase, β-glucanase, and α-galactosidase (CIBENZA CSM, Novus International, Inc.) and lactose on growth performance and gut health of young broilers. Rye, wheat and soybean meal based diet was formulated to meet or exceed nutrient requirements of broilers. High level of rye (38%) and wheat (23%) inclusion along with a mild mixed species Enterococcus challenge on d 0 were employed to create enteric challenge characterized by dysbacteriosis in broilers, in which effect of dietary enzyme, lactose and their interaction were tested. The study consisted of 4 dietary treatments in a 2 × 2 factorial arrangement with 2 levels of enzyme (0, 500 g/ton) and 2 levels of lactose (0, 0.1%). Each diet was fed to 16 replicate pens of 8 broilers from 0 to 29 d of age. Growth performance, including body weight, feed intake, FCR, and mortality was determined at d 7, 13, 21, and 27. Serum α-1 acid glycoprotein, ileal Clostridium perfringens, eecal pH, ileal lactobacilli, and digesta viscosity were measured on d 12, 15, 23, 28, and 29 respectively. Enzyme supplementation significantly increased body weight, feed intake, and improved FCR of broilers on each weigh day whereas lactose improved FCR in the absence of enzyme supplementation after d 13 (lactose x enzyme, P < 0.05). Birds fed diets supplemented with enzyme had significantly lower serum α-1 acid glycoprotein concentration, less ileal Clostridium perfringens and reduced digesta viscosity regardless of lactose supplementation (P < 0.05). None of the gut health parameters measured were significantly affected by lactose. In summary, in a broiler enteric dysbacteriosis model, nonstarch polysaccharides (NSP) degrading enzymes were effective in improving growth performance and gut health of broilers and lactose was also able to recover some performance loss when dietary NSP enzymes were not present.

Key Words: broiler, gut health, nonstarch polysaccharides enzyme, lactose

266 Use of a slope ratio assay to determine comparative efficacy of E. coli vs. Buttiauxella phytases in broilers. P. W. Plumstead*, C. Kwakernaak1, and J. D. van der Klis2, 3Danisco Animal Nutrition, Marlborough, UK, 4Schoorhorst Feed Research, PO Box 333, 8200 AM Leyslyst, the Netherlands.

A new 6-phytase derived from Buttiauxella spp. expressed in Trichoderma reesei has been developed and shown previously to be more effective vs. E. coli phytase sources at hydrolyzing phytate P in vitro. The objective of the present study was compare in vivo efficacy of the new phytase vs. E. coli derived phytase from 3 different sources using a slope ratio analysis. Three broiler trials were conducted. In each trial, 9 dietary treatments were fed to Ross 308 male broilers from 5 to 21d of age. A basal diet (negative control, NC) deficient in Ca and P was used. Phytase products and diets were assayed to determine the relative efficacy of each phytase were obtained by multiple linear regression with Trial included as a random effect in the mixed model. The interaction of phytase dose*dependent variable was significant (P < 0.001) for both tibia ash and ileal P digestibility, with a higher slope for Buttiauxella vs. E. coli phytase. This can be interpreted as Buttiauxella phytase being significantly better than E. coli phytase in increasing dietary P utilization in broilers.

Key Words: broiler, phytase, phosphorus, digestibility, bioefficacy


A factorial method was developed to measure the net energy for maintenance (NEm) based on heat production and ME intake. An isotope dilution technique with 15N-threonine enrichments and a regression method were assayed to determine the endogenous losses of protein (ELP) and the latter method to determine the endogenous losses of fat (ELF). Chicks were fed isocaloric pair-fed diets increasing the content of fat, protein, or fiber by adding poultry fat, soybean meal, pro-plus, or barley and these diets mixed with 0.05% of Robavio Max. Chicks fed diets without enzyme showed a significant higher NEm (135 vs 53 kcal/BW0.75) than those chicks fed diets with enzyme. The ELF were less (P < 0.05) when chicks fed diets with enzyme (1.9 g/kg DMI) than when they were fed diets without enzyme (6.4 g/kg DMI). The ELF determined by the isotope dilution technique were reduced (P < 0.05) when chicks fed diets with enzyme (23.5 g/kg DMI) compared with those birds fed diets without enzyme (33.5 g/kg DMI). A similar pattern was observed between the regression method and isotope dilution technique but ELP by the regression method were significantly similar (24.8 vs 33.5 g/kg DMI). The ME system may overlook the energy cost from the gastrointestinal tract. The energy cost calculated from ELF and ELP produces a potential energy use of 104 kcal/kg DMI [(33.5–24.2)g x 5.66kcal/g+(6.4–1.9)g x 9.35kcal/g] for diets with enzyme. The sparing of endogenous protein or fat in these diets may be directed to carcass protein (CP) or fat (CF) gain (0.16 g CP/digested protein, P-value < 0.001; 0.286 g CF/digested fat, P-value = 0.008) and computes an extra of 20 kcal of NE for gain/kg DMI. Further, the reduced secretion of endogenous protein or fat by the gastrointestinal tract may also reduce concomitantly the NEm. Thus the NEm in diets without enzyme was 61 (135x0.441kg BW0.75/0.979kg DMI) and with enzyme 24 (53x0.445kg BW0.75/0.981kg DMI), sparing 37 kcal/kg DMI for diets with enzyme. In this study, the enzyme supplementation reduced the NEm, ELF, and ELF saving 57 kcal/kg DMI.

Key Words: enzyme, net energy for maintenance, endogenous nutrients