# Energy Digestibility of a High Protein DDGS Product in Broilers

## A.S. Leaflet R3257

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### Summary and Implications

Changes to the production method of distiller's dried grains with solubles (DDGS), a common feedstuff in poultry diets, can alter the nutrient profile and energy content. Estimates of DDGS digestibility vary as a result of the altered production method, removal of value-added products like distiller's corn oil, as well as the strain of chicken used (broiler vs. layer). The objective of this study was to determine the energy digestibility of high protein DDGS (HiP DDGS) fed to straight-run Cobb 500 broiler chickens. The apparent nitrogen-corrected metabolizable energy of HiP DDGS was calculated at 2,710 kcal/kg. Additional research is needed to further illustrate the influence of production method on HiP DDGS feeding value in broiler chickens.

### Introduction

The increased diversion of corn to the ethanol industry has led to the increased use of co-products from the dry-milling process as an ingredient in animal feed. Distillers dried grains with solubles (DDGS) are used in poultry diets due to the significant amounts of minerals, fiber, crude protein, amino acids, energy and other important nutrients. Changes can be made during the processing of DDGS that can result in altered nutrient profiles such as an increased percentage of crude protein in high protein DDGS (HiP DDGS). The HiP DDGS used in this study contain ≥34% crude protein as fed, compared to an average of 27% crude protein seen in conventional DDGS. Changes to the processing method used also resulted in a slightly increased metabolizable energy (ME) of 2,627 kcal/kg in HiP DDGS compared to 2,619 kcal/kg in DDGS. To evaluate the energy digestibility of HiP DDGS, nitrogen-corrected apparent metabolizable energy ($AME_n$), a measure of the energy feeding value to poultry that corrects for nitrogen, was calculated based on previous research (Rochell et al, 2011). The objective of this study was to determine the effects of HiP DDGS on energy digestibility in broiler chickens.

### Materials and Methods

All experimental protocols involving animals were approved by the Iowa State University Institutional Animal Care and Use Committee. One hundred and twenty 6-week-old Cobb 500 broiler chickens were housed in 4ft x 4ft floor pens with 10 birds per pen and an equal representation of males and females. Each pen was randomly assigned to 1 of 2 energy digestibility test diets for a total of 6 replicates per treatment. The 2 dietary treatments consisted of an 85% complete basal diet with sucrose as a control and the same basal diet with HiP DDGS replacing sucrose (Table 1). Both diets contained 0.50% titanium dioxide as an indigestible marker. Birds were given ad libitum access to food and water through a round feeder and nipple waterer for 7 consecutive days. At the end of 7 days, birds were euthanized by carbon dioxide to collect ileal and cecal digesta. All samples were pooled by pen and stored at -20°C until the conclusion of the experiment.

Prior to analysis, diet and digesta samples were dried in a 100°C forced air oven and ground through a 1 mm screen in a Wiley mill (Arthur H. Thomas Company, Philadelphia, PA). All diets were analyzed for dry matter (DM), crude protein, crude fat, gross energy, and titanium dioxide concentration. Digesta samples were analyzed for DM, gross energy, crude protein, and titanium dioxide concentration.

Energy digestibility of the HiP DDGS was calculated using a series of equations: The total nitrogen-corrected apparent metabolizable energy ($AME_n$) intake of each dietary treatment was determined using the following equation with 8.73 as the nitrogen correction factor: $AME_n$ intake = [gross energy intake - gross energy excretion] – [8.73 x (nitrogen intake – nitrogen excretion)]. The contribution of $AME_n$ from glucose was subtracted from the total $AME_n$ intake of the sucrose control diet to determine the basal $AME_n$ intake using the following equation: basal $AME_n$ intake = $AME_n$ of control diet – 3,640 kcal of ME/kg of glucose. The $AME_n$ of HiP DDGS was then calculated using the following equation: HiP DDGS $AME_n$ = (Total $AME_n$ intake – basal $AME_n$ intake)/ co-product intake.

### Results and Discussion

The calculated $AME_n$ of HiP DDGS was 2,710 ± 162.3 kcal/kg (Table 2). A study done by Rochell *et al.* (2011) reported the AMEn of 6 sources of DDGS ranged from 2,146 to 3,098 kcal/kg, with an average of 2,675.5 kcal/kg. The same study reports the AMEn of two sources of HiP DDGS as 2,708 and 2,932 kcal/kg, averaging at 2,820 kcal/kg.

The calculated average AMEn of the HiP DDGS used in this study falls within published ranges for DDGS and other sources of HiP DDGS, but is lower than the average for both DDGS and HiP DDGS. The differences in $AME_n$ are likely due to the variable nutrient composition across different sources of DDGS as well as differences in the processing methods used. Additional research is needed to further predict the value of feeding HiP DDGS to broiler chickens based on the type of processing modifications during production of DDGS, including additional extraction of energy or fiber.

**Table 1.** Composition of experimental diets fed to Cobb 500 broilers for 7 consecutive days to determine the energy digestibility of HiP DDGS.

| Ingredients | Basal Diet (%)[1] | |
|---|---|---|
| Corn | 62.63 | |
| Soybean Meal | 32.59 | |
| Salt | 0.52 | |
| DL Methionine | 0.28 | |
| Limestone | 1.13 | |
| Dicalcium Phosphate | 1.72 | |
| Vitamin Premix[2] | 0.63 | |
| Titanium Dioxide | 0.50 | |
| | Experimental Diets (%) | |
| Basal | 85 | 85 |
| Sucrose | 15 | 0 |
| HiP DDGS | 0 | 15 |
| Analyzed Values | | |
| Moisture (%) | 10.84 | 12.72 |
| Dry Matter (%) | 89.16 | 87.28 |
| Crude Fat (%) | 1.77 | 3.36 |
| Crude Protein (%) | 15.76 | 21.72 |
| Energy (cal/g) | 3730.02 | 3844.37 |
| Titanium (%) | 0.52 | 0.51 |

[1] Experimental diets used a common 85% complete basal diet combined with sucrose or HiP DDGS.
[2] Vitamin and mineral premix provided per kg of diet: selenium 250 µg; vitamin A 8,250 IU; vitamin $D_3$ 2,750 IU; vitamin E 17.9 IU; menadione 1.1 mg; vitamin $B_{12}$ 12 µg; biotin 41 µg; choline 447 mg; folic acid 1.4 mg; niacin 41.3 mg; pantothenic acid 11 mg; pyridoxine 1.1 mg; riboflavin 5.5 mg; thiamine 1.4 mg; iron 282 mg; magnesium 125 mg; manganese 275 mg; zinc 275 mg; copper 27.5 mg; iodine 844 µg.

**Table 2.** Calculated $AME_n$ of HiP DDGS

| HiP DDGS |
|---|
| $AME_n$ (kcal/kg) [1] |
| 2709.64 ± 162.294 |

[1] $AME_n$ presented as average $AME_n$ of 6 replicate cages ± standard error