ENERGY VALUE OF CORN CO-PRODUCTS AS AFFECTED BY FAT AND FIBER COMPONENTS

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Introduction

Several frustrations exist on the part of nutritionists who wish to use corn co-products from ethanol production. Of primary concern is the variability in the nutrient composition and quality (i.e., how much of the nutrients can be utilized by the turkey). This variability is compounded by continued changes in the process to produce ethanol from corn. Front end changes such as corn fractionation or back-end changes to remove or divert product streams have a large effect on the nutrient composition of the final product. Traditional dry-grind production involved the use of whole corn with removal of the majority of the starch and sugars during fermentation. The remaining components – protein, fat, fiber and minerals were concentrated in the dried product by approximately a factor of three. However, newer methods of production may employ corn fractionation (germ removal-fat and bran separation-fiber) prior to fermentation. This removal of corn germ reduces the oil content of the DDGS considerably but then is available for feeding as corn germ. Other modifications of the process involve extraction of the oil from syrup (soluble) which also reduces the oil content of the dried product. This oil is sold separately and may be eventually diverted into biodiesel production and will be lost as a source of energy for animal feeds.

The amount of oil removed by centrifugation seems relatively small. The crude fat content of the final product is reduced from 11% to approximately 5-7% crude fat in the dried product. A reduction of 2 percentage units of fat in product would equate to a reduction of approximately 180 kcal/kg ME (82 kcal/lb) content in the DDGS. If this particular DDGS was used at an inclusion level of 20% it would result in a caloric deficit, requiring approximately .5% more supplemental fat. This would add to the overall diet cost which could be substantial when fat costs are high. Additionally, if this decreased diet fat content was not known, feed conversion could be negatively affected.
Some preliminary information indicates that the decrease in energy content with the reduced fat could be substantially more than that simply related to the change in the crude fat content. In a pilot study, special batches of DDGS were prepared with varied amounts of syrup added back to the mash and dried. The reduction in energy content as determined in young turkeys from the maximum amount of soluble added back as compared to the dried grains produced without soluble addition was nearly 1000 kcal/kg or 455 kcal/ lb (DM basis). It is possible that other components such as fiber or heat damage to the protein or fat can negatively affect energy content more substantially than the change in crude fat.

The objectives of the study were to determine the metabolizable energy content of modified corn co-products including as related to nutrient content determined by in vivo

and in vitro methods and to compare DDGS which vary in fat and fiber content and assess the effect on market turkey performance especially feed conversion.

Materials and Methods

Plants producing conventional and reduced fat DDGS were identified and amounts obtained to complete a feeding trial to examine the influence of varied nutrient characteristics (fat and fiber) on market turkey performance during the grow finish period.

The treatments were:
1. Control diet, no DDGS, moderate energy level (ME-S)
2. Reduced energy, no DDGS (ME-R)
3. As 1 with crude corn oil
4. As 2 with crude corn oil
5. As 2 plus 20% DDGS (11% crude fat)(DDGS11)
6. As 2 plus 20% DDGS (9% crude fat) (DDGS9)
7. As 2 plus 20% DDGS (7% crude fat)(DDGS7)
8. As 5 isocaloric to Trt 1
9. As 6, Isocaloric to Trt 1
10. As 7, Isocaloric to Trt 1

Diets were formulated using digestible amino acids as determined by the cecetomized rooster model. Diet protein level would be established by using intact protein set to meet the digestible NRC thr at 100% of the NRC recommendation (thr). Metabolizable energy values used in formulation were based on previous studies and past experience. Choice white grease was used as the supplemental fat source for those treatments without corn oil. Diets were fed during the grow/finish periods (10-19 wks of age) to male Nicholas turkeys in 100 pens (10 turkeys/pen). The experimental design is a randomized block design with 10 replications (pens) per treatment. Analyses of variance would be conducted to determine treatment effects on gain, feed intake, and feed conversion. Metabolizable energy was determined as True Metabolizable (TMEn) using young turkeys (6-8 wks of age) for the DDGS and for the corn oil it was determined as apparent metabolizable energy (AMEn) determined with turkey poults.

Results

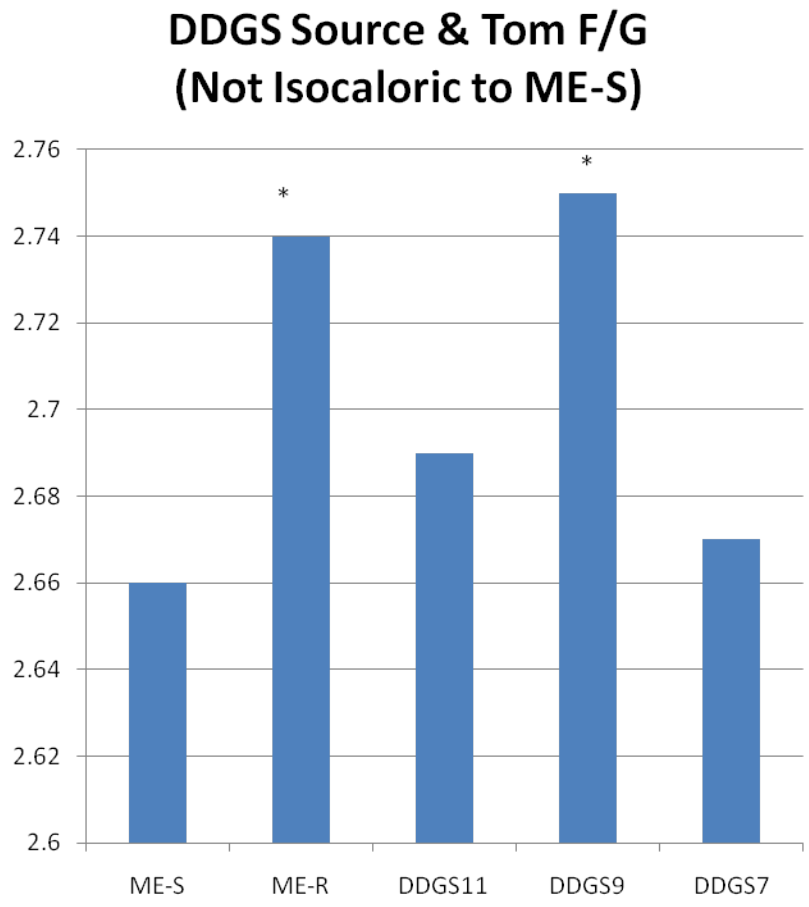
The TMEn for the three products were 2837, 2635, and 2701 kcal/kg (as fed) and the digestible lysine coefficients were 61, 62, and 74%, respectively for the products containing 11, 9, and 7% crude fat. No differences of significance were found for fiber. The AMEn of the corn oil was determined to be 10,000 kcal/kg which was greater than the gross energy content of 9400 kcal/kg.

Feed intake and feed efficiency of the turkeys was affected by treatment. Feed intake was greater and feed efficiency (f:g) was increased (2.66 vs. 2.74) when comparing the reduced ME diet (Treatment 2) to the control ME series (Treatment 1). Treatments 3

and 4 with corn oil performed similarly to the respective controls containing white grease (Treatments 1 and 2).

Comparing the substitution of 20% DDGS without any correction for energy (not isocaloric), indicated that only the 9% CF had poorer feed efficiency as compared to the standard ME control (Treatment 1) as shown in Figure 1.

Figure 1. Influence of DDGS crude fat content on feed efficiency of market toms during 10-19 wks of age. Treatments different from the control ME-S designated by * (P<.05).



Discussion

Assessing energy content of DDGS using feed efficiency as an indicator in this study was partially confounded by the tendency of the turkeys fed the DDGS diets, with the exception of DDGS9, as DDGS11 and DDGS7 tended to have better gain compared to the control treatments without DDGS. Thus the increased feed intake associated with the DDGS containing diets also responded with some increased gain perhaps

minimizing feed/gain responses among treatments. Similar TME values were obtained for DDGS9 and DDGS7 which were lower in crude fat than that for DDGS11. As the results indicate, the metabolizable energy value for DDGS which is lower in fat content should be decreased but the content of fat is probably not the only factor influencing the energy value. DDGS9 also had poorer lysine digestibility as compared to DDGS7 and perhaps poorer protein digestibility influenced the metabolizable energy content.

The energy value of the crude corn oil appeared to be overestimated by the AME assay. Based on results of the feeding trial, at a minimum, the AMEn of corn oil appeared to be similar to that of choice white grease (7550 kcal/kg).However, in the poult assay, the corn oil had greater metabolizable energy.

In conclusion, DDGS products with 11-12 % crude fat could be assigned ME of 2850 kcal/kg, 9-10 % crude fat, 2800 kcal/kg; and 7-8% crude fat, 2700 kcal/kg. Products with poorer amino acid digestibility may also influence the metabolizable energy content and additional adjustments may be needed.

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