Utilization Of Glycerin As A Source Of Energy In Market Turkey Diets

Final Report

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Principle Investigator: Sally Noll, Professor

Address: Department of Animal Science, University of Minnesota, 1364 Eckles Ave., St. Paul, MN 55108; 612-624-4928; nollx001@umn.edu
Introduction

Glycerin is produced as a co-product of the conversion of fats (triglycerides) into biodiesel. The process removes the fatty acids from the triglycerides leaving the glycerin portion of the fat molecule along with some of the remaining components of the process including methanol, sodium or potassium. The product is referred to as crude glycerin and contains about 80-88% glycerol (Dozier et al., 2008a). The glycerin can be metabolized and utilized as a source of energy by poultry although its value as an energy source will be quite a bit less than that of a fat source. The energy value of crude glycerin was estimated to be 1558 kcal/lb in broilers and 1726 kcal/lb in egg layers (Dozier et al., 2008b; Lammers et al., 2008).

Some feeding trials have been previously conducted to examine the inclusion of glycerin in poultry diets. At the University of Arkansas (Cerrate et al., 2006), inclusion of 10% glycerin depressed growth possibly due to reduced feed flow rate while inclusion of 5% did not have any negative effects on broiler performance. As it is anticipated that biodiesel production will continue to increase and that supplies of crude glycerin will be available, the objective of the research was to examine glycerin as a source of energy in market turkey diets for heavy tom production.

Procedures

Glycerin was examined as an energy source in diets of low and high nutrient density in market turkey diets. Glycerin was added at levels of 2, 4, 6, and 8% with concurrent adjustments in corn levels. The low nutrient density diets had energy levels reduced using a minimum of 1% added fat with amino acids (lys, M+C, thr) reduced proportionately. As glycerin replaced corn, levels of lysine, methionine, and threonine were adjusted back to the control diet for each nutrient density series. The base diet contained corn, soybean meal, poultry byproduct meal, and distillers dried grains with solubles (20%).

The dietary treatments were:
  1) Control – high nutrient density diet series, 0% glycerin
  2) As 1 with 2% glycerin
  3) As 1 with 4% glycerin
  4) As 1 with 6% glycerin
  5) As 1 with 8% glycerin
  6) Control – low nutrient density diet series, 0% glycerin
  7) As 6 with 2% glycerin
  8) As 6 with 4% glycerin
  9) As 6 with 6% glycerin
  10) As 6 with 8% glycerin
Diets were formulated using digestible amino acids as determined prior to the start of the trial. Corn, soybean meal, DDGs, and poultry byproduct meal are assayed using cecotomized roosters (in cooperation with Dr. Carl Parsons, University of Illinois). Chemical analyses (protein, fat, fiber, dry matter, minerals, and amino acids) of the ingredients was conducted prior to the start of the trial. Glycerin was analyzed for water content. Each diet was fed to 9 replicate pens of tom turkeys.

All diets were supplemented with supplements of lysine and methionine to meet the specific NRC recommendations for these amino acids. Supplemental thr use was limited to .05% in the control HND and LND diets.

Male Nicholas poults (1100 poults) were brooded in 50 pens and then randomized by weight at 8 wks of age into 90 pens (10 turkeys/pen) to assure equivalent starting weights. All of the poults were fed the same pre-experimental diets to 8 weeks of age prior to the start of the trial. Experimental diets were started at 8 wks of age and fed to 19 wks of age. The trial started in early December and was completed in late February.

Turkey body weight and feed consumption were determined at 8, 11, 14, and 17, and 19 wks of age. At 19 wks of age, 1 bird per pen for Treatments 1-5 was brought to the Meats Lab on campus and processed. Parts yield and abdominal fat measurements were taken.

The experimental design was a randomized block design. Analyses of variance was conducted to determine treatment effects on gain, feed intake, and feed conversion.

**Results**

Body weight. At 19 wks of age, lowering nutrient density decreased tom body weight by 2.9% (about 1.2 lbs or .6 kg). Lowering nutrient density had the least effect during 8-11 wks and the most effect during 17-19 wks of age. Addition of glycerin to the HND series did not affect body weight although at 19 wks of age BW was lower for the 6 and 8% levels. For LND series, glycerin addition of 6 & 8% depressed weights at 14 and 19 wks of age. The average response to glycerin addition is shown in Figure 1.

Average daily gain. Differences in ADG between the HND and LND diet series paralleled that of body weight. Glycerin addition in the HND series had no affect on gain except during 17-19 wks where glycerin addition at all levels resulted in decreased ADG. For the LND series, glycerin addition at 4, 6, and 8% decreased gains during 17-19 wks of age and the 6 and 8% level of addition decreased cumulative gains significantly.
Average daily feed intake. Lowering the nutrient density resulted in increased feed intake indicating the turkeys were responding to the lowered energy and protein level in the LND diet. Glycerin addition (6 and 8%) to the HND diet series resulted in some decreased feed intake after 14 wks of age and during the 17-19 wks of age was probably responsible for the decreased gain. In the LND series, glycerin addition during 17-19 wks decreased feed intake at the 6 and 8% levels of addition.

Feed efficiency. In contrast to body weight, differences in feed conversion for the HND and LND diets were noted immediately during the first feeding period of 8-11 wks of age. Feed efficiency was increased by 6% during 8-11 wks of age and by 14% during 17-19 wks of age. Glycerin addition in the HND diet series had no effect through 14 wks of age. During 14-17 wks, glycerin addition tended to improve feed efficiency. During 17-19 wks of age, feed efficiency was increased with glycerin addition. In the LND series, glycerin addition had no effect on feed efficiency with the exception of addition of 4 and 6% levels which increased feed efficiency during 17-19 wks of age. The average response to glycerin addition for feed efficiency during 8-19 wks of age is shown in Figure 2.

Carcass and parts yield and abdominal fat. For the high nutrient density diets, one turkey per pen nearest the pen mean for body weight was selected for carcass yield testing resulting in 10 turkeys processed per treatment. The yield of breast meat, drums, and thighs was not affected by glycerin addition. The yield of wings (expressed as amount per bird, or yield as percent of chilled carcass weight or fasted live weight) was affected by glycerin addition. The response was quadratic with yield reduced initially by glycerin in comparison to the control and then increased at the highest levels of supplementation. Abdominal fat was inconsistently affected by glycerin addition with the 4% addition of glycerin increasing abdominal fat content over that of the control and the other glycerin treatments.

Conclusions

Nutrient density had about a seven times greater effect on feed conversion as compared to body weight. Glycerin addition to 4% of the diet had no negative effects on performance but higher levels of 6 and 8% tended to be detrimental to body weight and feed intake especially during 17-19 wks of age. This negative effect may be due to the reduction in corn content in exchange for glycerin or a differential in utilization of different dietary energy sources (carbohydrate vs fat). Carcass and parts yield was not altered with addition of glycerin with the exception of yield of wings and abdominal fat.

The study found that crude glycerin can be added up to 4% of the diet for grow/finish market turkeys without detrimental effects on performance and was able to replace some corn in the diet as an energy source. On average, 78 lbs of corn per ton could be replaced with 80 lbs glycerin per ton. Supplementation with
additional amounts of amino acids (lys, meth, thr) was also needed to replace those amino acids from the corn. Depending on the cost of the corn and the supplemental amino acids relative to glycerin, glycerin has the potential to reduce diet cost in market turkey feeding.