

Digestibility of amino acids in corn and corn co-products fed to growing pigs

Grant. I. Petersen and Hans. H. Stein

*Department of Animal Sciences, University of Illinois, Urbana, IL 61801

SUMMARY

The objective of this experiment was to measure the standardized ileal digestibility of crude protein and amino acids in hominy feed, corn gluten meal, corn gluten feed, and corn germ meal and to compare these values to the digestibility of crude protein and amino acids in corn and distillers dried grains with solubles (DDGS). Results showed that the digestibility of most amino acids were greater ($P < 0.05$) in hominy feed and in corn gluten meal than in the other ingredients, whereas the digestibility of most amino acids in corn gluten feed was lower ($P < 0.05$) than in the other ingredients. For lysine, digestibility values of 79.6, 76.4, 61.0, and 28.6% were measured for hominy feed, corn gluten meal, corn germ meal, and corn gluten feed, respectively. The digestibility of lysine in DDGS source 1 was lower ($P < 0.05$) than in DDGS source 2 (46.1 vs. 65.4%), but no differences between these 2 ingredients were observed for the other amino acids. The SID of most amino acids in corn germ meal were lower ($P < 0.05$) than in corn, but for most amino acids, digestibility values in corn germ meal were not

different from the digestibility of amino acids in DDGS. It is concluded that corn gluten feed has a very low digestibility of amino acids and should not be used in diets fed to swine. Hominy feed and corn gluten meal have digestibility values for most amino acids that are greater than in corn and in DDGS, whereas the digestibility of most AA in corn germ meal is similar to the digestibility of amino acids in DDGS.

Key words: Amino acid digestibility, corn germ meal, corn gluten feed, corn gluten meal, hominy feed, pigs

INTRODUCTION

Co-products from the corn milling industry include DDGS, hominy feed, corn gluten meal, corn gluten feed, and corn germ meal. Hominy feed is a co-product from the dry milling industry when corn is used to produce corn grits, corn meal, or corn flour. Corn gluten meal, corn gluten feed, and corn germ meal are co-products from the wet milling industry, whereas DDGS is a co-product from the ethanol industry.

With the increased interest in feeding co-products to swine, values for the digestibility of crude protein and amino acids in corn co-products are needed. The objective of the current experiment was, therefore, to measure the standardized ileal digestibility of crude protein and amino acids in hominy feed, corn gluten meal, corn gluten feed, and corn germ meal by growing pigs and to compare these values to the digestibility of amino acids in DDGS and in corn.

MATERIALS AND METHODS

Eight growing barrows (initial BW: 55.0 ± 0.85 kg) that were the offspring of line 337 boars mated to C 22 females (Pig Improvement Company, Hendersonville, KY) were randomly allotted to an 8 x 8 Latin square design with 8 diets and 8 periods. Pigs were equipped with a T-cannula in the distal ileum and housed in individual pens (0.9 x 1.8 m) that had fully slatted floors. A feeder and a bowl drinker were installed in each pen.

Two sources of traditional DDGS produced by 2 different companies located in SD and OH, respectively, were used (Table 1). Both products were produced by ethanol plants constructed within the last 10 years and similar production techniques were used by the 2 plants. Hominy feed (Agricore Inc., Marion, IN), corn gluten meal and corn gluten feed (Archer Daniels Midland, Decatur, IL), and corn germ meal (Cargill Inc., Eddyville, IA) were also procured. A locally grown commercial hybrid of yellow dent corn was sourced from the University of Illinois Feed Mill.

Eight diets were prepared. Seven of the diets contained corn or 1 of the corn-co-products as the sole source of crude protein and amino acids. A N-free diet that was used to measure basal endogenous losses of crude protein and amino acids was also formulated.

Pigs were fed each diet for 7 days. The initial 5 days were considered an adaptation period to the diet, but ileal digesta were collected on d 6 and 7 by attaching a plastic bag to the opened cannula barrel using an autolocking cable tie. Collected samples were analyzed for crude protein and amino acids and values for the digestibility of crude protein and amino acids for each ingredient were calculated.

RESULTS AND DISCUSSION

All pigs stayed healthy throughout the experiment and readily consumed their diets. Values for the digestibility of crude protein and amino acids are presented in table 2. The digestibility of most amino acids in hominy feed and in corn gluten meal was greater than in the other ingredients and the digestibility of all amino acids in corn gluten feed was lower than in all other ingredients. The digestibility of most amino acids in corn germ meal and in DDGS was not different from the digestibility of amino acids in corn. However, the other source of DDGS had digestibility values for some amino acids that were lower than in corn.

The values for the digestibility of amino acids in corn that were measured in this experiment agree with previous data (NRC, 1998). The digestibility of all amino acids except lysine in the 2 sources of DDGS that were used in this experiment are also close to previously measured values, but the low digestibility of lysine in one of the 2 DDGS sources show that variation among sources of DDGS exist. This needs to be taken into account if DDGS is used in diet formulations.

We are not aware of any other data on the digestibility of amino acids in corn germ meal that have been measured in North America, but the values that were measured in this experiment agree with data for the digestibility of amino acids in European corn germ meal (Sauvant et al., 2004). Although the digestibility of most amino acids in corn germ meal are slightly lower than in corn, the values measured in this experiment are very close to the average values for the digestibility of amino acids in DDGS (Stein and Shurson, 2009). It is, therefore, expected that corn germ meal can be used as an acceptable source of amino acids in diets fed to swine.

The digestibility of amino acids in hominy feed were equal to or greater than in corn, and none of the other corn co-products had digestibility values of amino acids that were greater than in hominy feed. To our knowledge, this is the first time digestibility values have been measured in hominy feed in the US and we are not aware of any published reports from North America with such information. Values for the digestibility of amino acids in hominy feed measured in Europe have, however, been published (Sauvant et al., 2004), but those values are less than the values measured in the present experiment. Based on the values measured in this experiment, it is concluded that crude protein and amino acids in hominy feed are well digested by pigs. Hominy feed also has a high concentration of starch and a relatively low concentration of fiber, which makes it an attractive feed ingredient in diets fed to swine.

The digestibility of protein and amino acids in corn gluten meal was similar to those measured in hominy feed and either greater than or equal to the values measured in corn. The values measured in the present experiment concur with previously published values from North America (NRC, 1998), but they are slightly less than European values (Sauvant et al., 2004). The high concentration of AA in corn gluten meal and the relatively high values for the digestibility of amino acids indicate that corn gluten meal is a good source of amino acids that can be used in diets fed to swine.

The digestibility of crude protein and amino acids in corn gluten feed were much lower than the values obtained for any of the other feed ingredients and also lower than previously reported values (NRC, 1998). The amino acid profile of the protein in corn gluten feed was different from that of corn, which indicates that not all the corn protein is included in corn gluten feed. The very low digestibility of lysine in corn gluten feed also

indicates that the source of corn gluten feed used in this experiment may have been overheated. The results of this experiment suggest that corn gluten feed is not a suitable feed ingredient for swine diets.

CONCLUSIONS

Data from the present experiment indicate that amino acids in hominy feed and in corn gluten meal are well digested by pigs and these 2 ingredients may, therefore, be used in diets fed to swine. Amino acids in corn germ meal have a lower digestibility than those in hominy feed and corn gluten meal, but for most amino acids the digestibility in corn germ meal is close to the digestibility of amino acids in DDGS. The current data also confirm that most amino acids in DDGS have digestibility values that are slightly lower than in corn, but the digestibility of lysine may vary among sources of DDGS. Amino acids in corn gluten feed are poorly digested by pigs and corn gluten feed should not be used in diets fed to swine.

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