INFLUENCE OF CEREAL GRAIN TYPE AND METHOD OF PROCESSING ON PROTEIN AND STARCH DIGESTION IN FEEDLOT STEERS

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Protein flow to the small intestine of the ruminant is the sum of the dietary protein which escapes ruminal degradation and the microbial protein synthesized in the rumen. Protein from ruminal bacteria and protozoa alone are insufficient to meet animal needs at high levels of production. Thus, the proportion of ruminal escape protein can affect animal performance. New models to formulate protein in diets for ruminants require one to use estimates of ruminal escape. This study is an attempt to provide more quantitative information on the extent of protein degradation in the rumen. Of particular concern is protein from the cereal grains which often provides the majority of the dietary protein in diets.

Cereal grains usually are processed to improve feed efficiency. Certain processing methods not only increase total tract digestibility, but also can alter the site (ruminal vs intestinal) and extent of digestion and absorption of both protein and starch. Certain feed processing methods (pelleting, extrusion, steam rolling and flaking) generate enough heat to alter feed protein. Heating also disrupts the crystalline structure of cereal starches and greatly increases its rate of digestion. Whether heating renders protein less susceptible to ruminal attack probably depends on the degree of heat and the type of protein.

Detailed information on the amino acid profiles of cereal grains escaping ruminal digestion and reaching the small intestine is needed. One direct approach to determine the amino acid composition of escape cereals is to measure the amino acid composition of residues of feedstuffs remaining after digestion in dacron bags in the rumen.

The objectives of this study are to determine the differences in ruminal protein escape among corn, wheat, oats, barley and sorghum grain. Grain processing methods will be examined to determine their effect upon protein degradation of the cereal grain in the rumen and intestine. Amino acid profiles of the residual protein will be studied, and the relationships among pH, nitrogen solubility, and ruminal nitrogen disappearance of the cereal grains will be assessed.

Five steers fitted with ruminal and intestinal cannulas are being used. Diets consist of cereal grain (77%), cottonseed hulls (12%), and other minor dietary ingredients. Treatments include rolled corn, wheat, oats, sorghum grain, and barley; steam rolled barley; whole oats; high moisture corn (25% and 35%); steam flaked corn, wheat, and sorghum grain; and whole shelled corn. Steers are fed twice daily at 1.5% body weight. Particulate and fluid passage rates are being measured. Other chemical analyses will be performed to determine the site and extent of digestion of the starch, protein and acid detergent fiber content of the cereal grains.

The effect of the cereal grain and processing method on the disappearance of amino acids from the grain suspended in dacron bags in the rumen will be studied with three ruminally cannulated steers fed diets at intakes described above. Triplicate bags containing the cereal grains to be fed are being suspended in the rumen of each animal

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for 4, 12 or 24 hours. Residues from one of the triplicate bags as well as undigested substrates will be analyzed for amino acid composition. Dry matter and nitrogen disappearance rates will be determined on the other two duplicate bags.

Ruminal escape of total protein and amino acid nitrogen from these cereal grains processed in various manners will be statistically analyzed. Potential predictability from in situ and solubility data will be calculated. Determined values should be valuable as input data for models of protein nutrition which will enable one to calculate more productive least-cost diets for high-producing ruminant animals.