EFFECT OF HYDROGEN PEROXIDE ON PROTEIN DEGRADATION OF FEATHER MEAL

C. A. Löest, E. C. Titgemeyer, J. S. Drouillard, and C. M. Coetzer

Summary

Protein degradation of feather meal treated with hydrogen peroxide was evaluated using the *in situ* bag technique. Bags containing untreated feather meal or feather meal treated with 1.4, 2.5, 2.7, 5.0, or 7.0% hydrogen peroxide (g/100 g feather meal, as fed basis) at various pH and times of heating (55°C) were suspended in the rumen of a cannulated steer for 12 hours. Protein degradabilities of feather meal treated with 2.5 and 2.7% peroxide were only 12 to 19% greater than untreated feather meal, but feather meal treated with 5% peroxide had protein degradabilities 56 to 67% greater than untreated feather meal. Treatment of feather meal with 7% peroxide did not increase protein degradation further. Altering pH and heating (55°C) peroxide-treated feather meal for 30 or 120 minutes had only minor effects on protein degradability.

Introduction

Performance of feedlot cattle can be improved when high-grain diets are supplemented with rumen degradable, true protein sources. Protein sources that have low rumen degradation values, however, have little value for such cattle. This suggests that the protein supply to the small intestine is already adequate to meet the animal's postruminal requirements, and that responses to degradable, true protein are probably due to enhanced ruminal fermentation and consequently increased dietary energy utilization.

Feather meal, a by-product of the poultry industry, is high in crude protein (approximately 85%), but only a small fraction (30%) of this protein is degradable in the rumen. Increasing the ruminal degradability of feather meal protein and other high ruminal escape protein sources may improve their value in finishing diets for cattle.

Our objective was to evaluate the protein degradability of feather meal treated with hydrogen peroxide, using the *in situ* bag technique.

Experimental Procedures

Laboratory Experiments. Several laboratory experiments were conducted to evaluate the effect of hydrogen peroxide on rumen degradability of feather meal protein.

In Exp. 1, 10 g of 0, 4.0, 7.8, and 14.7 molar solutions of hydrogen peroxide were added to 100 g of feather meal (as fed basis). This allowed treatment of feather meal with 0, 1.4, 2.7, and 5.0% hydrogen peroxide (g/100 g feather meal), respectively.

In Exp. 2, 0, 5, 10, and 14 g of a 14.7 molar solution of hydrogen peroxide were mixed with 100 g of feather meal (as fed basis), which allowed treatment of feather meal with 0, 2.5, 5.0, and 7.0% hydrogen peroxide (g/100 g feather meal).

In Exps. 3 and 4, the effects of pH and temperature on the peroxide treatment of feather meal were examined. Hydrochloric acid (6 normal) or sodium hydroxide (40% wt/wt solution) were used to adjust the pH of feather meal to approximately 3.5 or 10.5. The feather meal was then treated with 2.5% hydrogen peroxide. Feather meal that had been treated with 2.5 and 5.0% hydrogen peroxide was also incubated at 55°C for 30 and 120 minutes.

For all experiments, hydrogen peroxide and feather meal were mixed for approximately 5 minutes using a portable food mixer, and then allowed to stand for at least 12 hours before protein degradabilities were measured.

Protein Degradation Assay. The protein degradabilities of peroxide-treated and untreated feather meal samples were measured using the *in situ* bag technique. Duplicate polyester bags (2 × 4 inches; pore size = 50 μm), containing either untreated or peroxide-treated feather meal were sealed using an impulse heat sealer. Bags were then soaked in warm water before being suspended for 12 hours in the rumen of a cannulated Holstein steer fed a 50% concentrate diet. Bags were rinsed with water, then dried in a forced-air oven at 55°C, and analyzed for nitrogen.

Protein degradabilities were calculated as 100% minus the percent of the original nitrogen remaining after 12 hours in the rumen.

Results and Discussion

Although there were no large changes in protein degradation when feather meal was treated with 1.4% hydrogen peroxide, *in situ* protein degradabilities were 12 and 19% greater for feather meal treated with 2.5 and 2.7% hydrogen peroxide than for untreated feather meal (Figure 1; Exp. 1 and 2). Furthermore, feather meal treated with 5.0% hydrogen peroxide had protein degradabilities that were 67% (Exp. 1) and 56% (Exp. 2) greater than that of untreated feather meal.

Increasing the peroxide treatment to 7.0% of feather meal also improved *in situ* protein degradation by 55% when compared to untreated feather meal, but did not increase protein degradation above that resulting from treatment with 5.0% hydrogen peroxide.

Altering the pH of feather meal before treatment with 2.5% hydrogen peroxide resulted in small increases in protein degradation (Figure 2; Exp. 3).

Protein degradabilities of feather meal treated with 2.5 and 5.0% peroxide were also slightly higher when heated to 55°C for 30 and 120 minutes (Exp. 4). However, protein degradation of feather meal treated with 2.5% peroxide was not greatly altered by heat treatment.

Treating feather meal with optimum amounts of hydrogen peroxide (about 5%) increases ruminal protein degradability of feather meal, which may improve the value of feather meal in finishing diets for cattle.

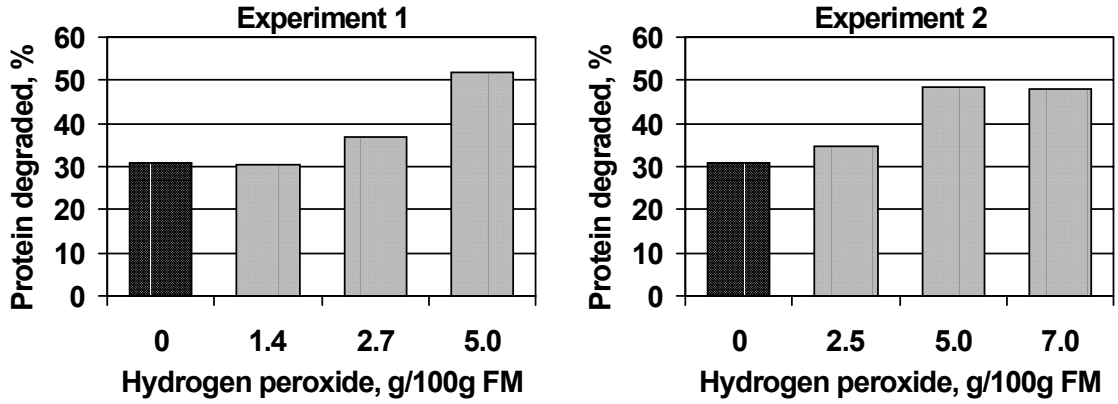

Figure 1. Effect of Hydrogen Peroxide on Protein Degradation of Feather Meal (FM).

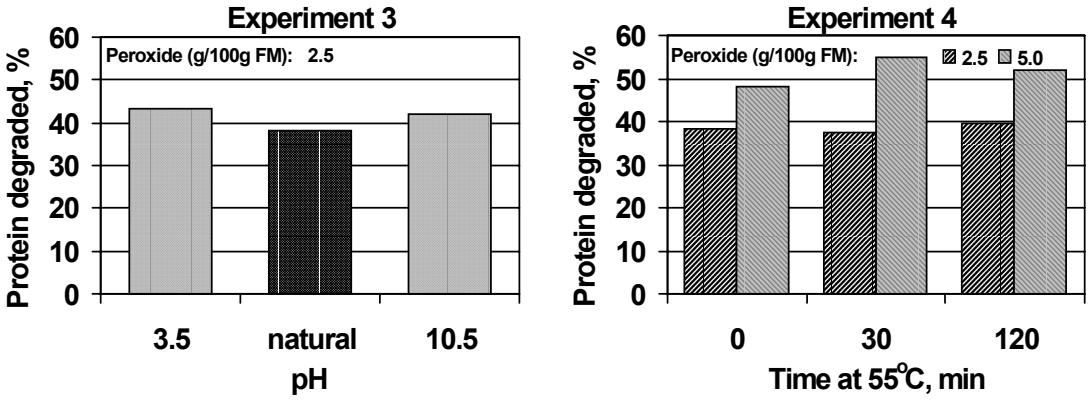

Figure 2. Effect of pH and Temperature on Feather Meal (FM) Treated with 2.5 and(or) 5% Hydrogen Peroxide (g/100 g FM).