RUMINAL FILL OF STEERS FED UNTREATED AND AMMONIATED WHEAT STRAW

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Story in Brief

Rumino-reticular contents of mature Hereford steers that were fed untreated or ammoniated wheat straw were evacuated to measure the effect of ammoniation on rumen liquid and particulate volumes and the amounts of free and imbibed liquid. Voluntary intake of straw increased by 30% with ammoniation. Total fluid mass in the rumen was similar with the two straws, but dry matter of rumen contents of steers fed ammoniated straw tended to be lower. Free fluid (% of total fluid) was decreased whereas the amount of fluid imbibed in particulate matter tended to increase in rumen contents of steers fed ammoniated straw. The greater amount of imbibed fluid in particulate matter of ammoniated straw may aid in penetration of the straw by bacteria or microbial enzymes thereby increase rate of digestion and straw intake.

(Key Words: Ruminal Volume, Ammoniated Wheat Straw.)

Introduction

Treatment of low-quality roughage with ammonia typically (1) increases digestibility of dry matter (DM) by 20 to 40%, (2) doubles the crude protein content and (3) increases the voluntary consumption by ruminant livestock by 20 to 35%. Increased consumption can account for a large proportion of the increased performance of ruminants fed ammoniated roughages. Zorrilla-Rios et al. (1985) studied the mechanism by which ammoniation increases intake of wheat straw by cattle and found that ammoniation of wheat straw (1) increases the fragility of straw, (2) increases the extent of in situ disappearance of DM at 6 and 12 hours of incubation and (3) increases both flow rate (L/h) of rumen liquids and dilution rate (%/h) of rumen particulate matter. The objective of this study was to measure the effect of ammoniation of straw on rumen liquid and particulate volumes and determine the relative amounts of free and imbibed liquid.

Materials and Methods

Six mature Hereford steers (1300 to 1495 lb) fitted with large rumen cannulae were housed in individual pens and fed twice daily either untreated (US) or ammoniated (AS) wheat straw in amounts of about 110% of voluntary intake. Wheat straw was ammoniated by the "stack method" as described by Sundstol et al. (1978) with 3.5% ammonia (DM basis) added. Both types of straw were coarsely chopped to lengths of about 2 inches prior to feeding. Steers of both diets were fed 2 lb of a 41% protein-mineral-vitamin A supplement daily. The cross-over

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experimental design used two consecutive 31-day periods that included 20 days for adaptation and 11 days for measurements. Voluntary straw intake was recorded daily, and rumino-reticular contents of each steer were removed 4 to 5 hours after one morning feeding. Whole rumen contents were separated into particulate and "free" liquid fractions by straining total digesta through a wire mesh screen with openings of 3 x 3 mm square. The total particulate fraction was then mixed and DM content of the particulate and "free" liquid fractions was determined by drying to constant weights in forced-air ovens at 65 C. The loss of weight of the particulate fraction during drying was designated as "imbibed" fluid whereas "total fluid" was calculated as free (corrected for suspended DM) plus imbibed fluid. Similarly, total DM was calculated as particulate DM plus DM suspended in the "free" liquid fraction.

Results and Discussion

Ammoniation of wheat straw increased the crude protein content from 3.16 to 9.19% of DM, and increased in vitro dry matter digestibility (IVDMD) from 46.0 to 55.5%. Voluntary intake of straw was increased 30% by ammoniation (Table 1). Steers fed AS had greater amounts (lb) of total solids in rumen contents. Total solids in the rumen, expressed as a percentage of daily straw DM intake, tended to be less with ammoniation though disappearance (passage plus digestion) tended to be lower (5.5 vs 6.0%/h) for ammoniated straw. The total amount of fluid in rumen contents of steers fed the 2 types of straw was similar. Free fluid (expressed as a percentage of total fluid) was decreased and the amount of fluid imbibed in particulate matter tended to be increased in rumen contents of steers fed AS. Physical distention of the rumen may be greater as the relative amount of free and imbibed fluid increases. However, feed intake was not affected by loading the rumen with water in studies of Campling et al. (1961) and Gharib et al. (1970), but water can be absorbed through the rumen wall whereas

Table 1. Least square means of voluntary straw intake and measurements of rumen contents.

Item	Type of straw		SE
	Untreated	Ammoniated	
Straw intake, lb DM.hd.$^{-1}$.d^{-1}	16.1	20.7	.48
Rumen content			
Total solids, lb DM	23.1	27.3	1.28
Total solids:daily straw intake, %	144.3	131.7	8.0
Total fluid, lb	172.5	173.6	4.84
Dry matter, %	11.7	13.5	.55
Free fluid, lb	58.5	43.6	5.94
Free fluid:total fluid, %	33.9	24.4	3.3
Imbibed fluid, lb	115.3	131.1	7.26

ruminal fluid containing salts is less readily absorbed. The greater amount of imbibed fluid in particulate matter of AS may aid inoculation or penetration of the straw by bacteria and thereby increase rate of digestion and straw intake.

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