INVESTIGATION ON BACTERIAL POPULATIONS IN RUMINAL FLUID OF SHEEP ADAPTED FROM PASTURE TO A HIGH-GRAIN DIET

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Diets containing large proportions of starch are widely used during lot feeding of cattle and in supplementary feeding of sheep. Under these conditions lactic acid may accumulate rapidly in the rumen and lead to lactic acidosis. In response to grain diet, lactate- and starch-utilizing bacteria in the rumen may increase in numbers and reduce the lactic acid accumulation (Mackie and Gilchrist 1979). As part of a study to test the hypothesis that adaptation to grain-based diets can be enhanced by increasing the numbers of some starch- and lactate-utilizing bacteria in rumen, we investigated the bacterial numbers in the ruminal fluid of sheep under different dietary regimes.

Two sheep grazing dry native pasture were penned individually and fed chaffed luceme hay (800 g/day). The sheep were then adapted to a diet consisting of 75% wheat plus 25% chaffed luceme hay (800 g/day). After 3 months on this diet the sheep were changed to 1 kg/day of a diet consisting of 50% wheat plus 50% chaffed luceme hay. Samples of rumen fluid were taken from these 2 sheep after 1 day on chaffed luceme hay, after 1 month on the 75% wheat diet, and after 1 month on the 50% wheat diet. The samples were strained through 4 layers of cheesecloth and serial dilutions were made. The number of lactate fermenters was measured by colony-forming units on the LH medium (Mackie and Gilchrist 1979). LH agar roll tubes were inoculated in triplicate at each of five dilutions (10^{-4},10^{-5},10^{-6},10^{-7},10^{-8}) and incubated at 38.5°C for 5 days. The number of colonies was determined from those roll tubes containing 10 to 50 colonies. The numbers of amylolytic bacteria (colony-forming units) were measured using a medium similar to the non-selective medium employed for enumerating total colony-forming units, except that 0.5% starch was added to replace the glucose and cellobiose. The non-selective medium of Klieve *et al.* (1989) was used with the following modifications: rumen fluid, 33 ml; peptone, 0.1 g; yeast extract, 0.1 g; volatile fatty acids solution (Caldwell and Bryant 1966) (pH7.5), 1 ml; distilled water, 33 ml.

Numbers of the bacteria found in the rumen fluid of sheep on different diets are presented in Table 1.

Table 1. Effect of diet on the rumen bacterial populations (log number of colony-forming units/ml of rumen fluid)

Group of organisms	Diet		
	Chaffed lucerne hay	75% Wheat	50% Wheat
Starch fermenters	5.87 ± 0.10	9.31 ± 0.32[A]	8.58 ± 0.13[A]
Lactate fermenters	5.43 ± 0.39	7.32 ± 0.25[B]	6.50 ± 0.27
Total bacteria	9.40 ± 0.19	10.0 ± 0.11	9.45 ± 0.15

Data are expressed as mean ± standard error of mean;
[A] Significantly different ($P < 0.01$) from the number of chaffed lucerne hay in same row;
[B] Significantly different ($P < 0.05$) from the number of chaffed lucerne hay in same row.

There was no apparent difference in numbers of total bacteria measured using the non-selective medium ($P > 0.05$). The numbers of starch-fermenters (amylolytic bacteria) in the rumen fluid of the sheep on grain diets was significantly higher than the number in the rumen fluid of the sheep on chaffed luceme hay ($P < 0.01$). The increase of the numbers of lactate-fermenters from pasture to the 75% of wheat diet was statistically significant ($P < 0.05$). Our results suggest that an increase in the numbers of the starch- and lactate-utilizing bacteria may be important in the ruminant's ability to adapt to grain-based diet.

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