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Amylolytic activity of solid-adherent microorganisms in rumen content and bag residues: influence of diet and nature of cereals into bags

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The extent of ruminal starch degradation depends on physical and chemical characteristics of the grain, microbial activity and residence time in the rumen. The aim of this study was to quantify the importance of microbial amylolytic activity in the process of starch degradation.

Three fistulated cows were used in a 3 x 3 Latin square design. They were fed a diet (7 kg DM) consisting of hay with 0 (B0), 30 (B30) or 60 % (B60) barley. Two cereals, rapidly (barley) and slowly (corn) degradable, ground through a 4 mm-screen, were put in polyester bags and introduced in the rumen at feeding time on two consecutive days. Bags and rumen digesta were with drawn 2 h or 23 h after feeding. Enzymes of solid adherent microorganisms, the greatest microbial population in term of biomass (Craig et al, 1987, J Nutr, 117, 56-62) and amylolytic activity (Martin et al, 1993, Curr Microbiol, 27, 223-228), were extracted by freezing-defrosting and sonication under anaerobic conditions (Nozière and Michalet-Doreau, 1994, Reprod Nutr Develop, 34, 281-288). They were incubated with starch at 39°C. Amylase activity was expressed as µmol glucose released per mg protein for 1 h.

Amylolytic activity extracted from rumen content was maximum 2 h after feeding. This activity increased from 1.1 to 9.7 units respectively with 0 and 60 % barley in the diet. Amylolytic enzyme capacity would not limit ruminal starch digestion since no plateau in the amylolytic activity was observed with increased level of starch in the diet.

Amylolytic activity inside the bags differed from the activity extracted from rumen content, and varied with the nature of cereal in the bag. After 2 h incubation time, amylolytic activity was higher in barley bags (11.8 units) than in corn bags (2.8 units). Between 2 h and 23 h, the activity decreased in barley bags as in rumen content, but tended to increase in corn bags. Moreover, activity inside the bags was not significantly modified by barley supplementation of the diet. These results would suggest that amylolytic activity of solid-adherent microorganisms would depend on amounts of starch available to be degraded, which would be related on nature of feed into bags, independently on the level of concentrate in the diet.

The ruminal degradation rate of starch would not be limited by the microbial amylolytic activity, but rather by the availability of starch.

Amylase activity (µmol glucose/mg protein in 1 h)

		Diet		
Sampling site	Time/feeding	B0	B30	B60
Rumen digesta	2 h	1.1	4.3	9.7
	23 h	0.6	1.3	3.8
Barley bags	2 h	12.3	10.6	12.5
	23 h	2.7	3.8	3.5
Corn bags	2 h	1.0	2.9	4.4
	23 h	5.9	6.3	3.3