SOME ASPECTS OF CARBOHYDRATE METABOLISM IN DEFAUNATED SHEEP

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Introduction

A lot of experiments indicate that the rumen protozoa elimination influences the carbohydrate metabolism in the rumen of ruminants (Demeyer and Van Nevel, 1975; Ushida et al., 1985).

The objective of this study was to clarify some aspects of carbohydrate metabolism in the digestive tract of sheep.

Materials and Methods

The study was carried out with 3 groups consisting of 3 male lambs each (equal in date and liveweight at birth). First group – faunated (F) – the animals were suckling from their dams and after weaning at 3 months of age were kept in a stable together with other sheep. Second group – defaunated (DF) – 48 h after birth the lambs were separated from their dams and were put in individual pens without contact with other animals. Third group – were DF animals which at 11 months of age were refaunated (RF) by 4-day infusion of 200 ml rumen content taken from F animals. At 3 months of age all animals were rumen cannulated and at 10 months of age were fitted with re-entrant cannulae at the proximal duodenum. With the exception of cow's milk which was given to DF during the first 3 months, all animals received the same ration. Before the animals were fed, all feeds were radiated by a bactericidal lamp. At 12 months of age all groups received a 1.2 kg concentrated mixture and 1.2 kg maize silage given in two portions daily. The measurement of rumen and duodenal parameters started 2 weeks after the refaunation.

Cellulytic activity was estimated by cotton thread incubated for 24 h in the rumen.

Results and Discussion

The concentration of hydrogen ions (pH) in the rumen content 2 h after feeding was lower in DF than in F animals (table 1). Duodenal digesta of DF animals after feeding observed lower pH values, too.

The total quantity of volatile fatty acids (VFA) in the rumen was lower in DF sheep ($p < .001$).

TABLE 1. CONCENTRATION OF HYDROGENE IONES (pH)

Hours after feeding	F	DF	RF
		Rumen content	
0	7^a	7^b	7
2	6^a	5^b	5
		Duodenal digesta	
0	3	3	3
2	3^a	4^b	2^b
4	4^a	3^b	3^b
7	4^a	3^b	3^b

^{a,b} – Differences between groups are significant at $p < .05$ if average values have different letters.

TABLE 2. TOTAL QUANTITY OF VOLATILE FATTY ACIDS mmol/100ml

Hours after feeding	F	DF	RF
		Rumen content	
0	3.6^a	2.1^b	2.7^b
2	7.1^a	6.6^b	6.7
		Duodenal digesta	
0	1.0^a	0.5^b	1.1
2	1.0^a	0.5^b	1.0
4	1.0^a	0.6^b	1.0
7	1.0^a	0.6^b	1.0

^{a,b} as in Table 1.

The differences in the duodenal digesta were similar (table 2).

The concentrations of acetic (C_2) and butyric (C_4) acids were lower, but of the propionic (C_3) acid was higher ($p < .001$) in DF animals compared to F (table 3). The molar proportion of C_2 in duodenal digesta was higher in all groups compared to rumen data. The cellulytic activity for 24 h "in situ" was 12 % lower for DF animals. The values of blood sugar and alkali reserves didn't differ significantly between F and DF animals.

The results showed that defaunation decreased the total quantity of VFA and the molar proportion of C_2 and C_4 in the rumen content compared to F animals. This decreasing of the total quantity of VFA should be explained with the lower rumen digestibility of organic matter (Ushida et al., 1984). In experiments with sheep fed concentrate and roughage, Ushida et al. (1985) found a decrease in acetate, butyrate, methane and CO_2 and an increase of propionate in the rumen.

It was suggested that protozoa produce hydrogen which later is used for CH_4 production and CH_4-production is connected with acetate production. The increase of propionate (Demeyer and Van Nevel, 1975) relates to the decreased production of methane in rumen.

(Key Words: Carbohydrates, Rumen, Duodenal Digesta)

TABLE 3. MOLAR PROPORTION OF VFA IN THE RUMEN, %

Hours after feeding	C_2	C_3	C_4
		Faunated	
0	64 [a]	23[a]	13[a]
2	62[a]	25[a]	13[a]
		Defaunated	
0	55[b]	34[b]	11
2	52[b]	40[b]	8[b]
		Refaunated	
0	61	29[b]	9[b]
2	56[b]	37[b]	8[b]

a,b -- as in Table 1.

Literature Cited

Demeyer, D.I. and C.J. Van Nevel. 1975. In Digestion and Metabolism in the Ruminant (Ed. by I.W. McDonald and A.C.I. Warner) Univ. New England Publishing Unit Armidale. Australia, pp.366-382.

Ushida, K., J.P. Jouany, Bernadette Lassales and P. Thivend. 1984. Protozoa contribution to nitrogen digestion in sheep. Can. J. Anim. Sci. (Suppl.) 64:20-21.

Ushida, K., M. Miyaziani and R. Kawashima. 1985. Effect of defaunation on ruminal gas and VFA production *in vitro*. Jap. J. Zootech. Sci. 57 /1/: 71-77.