EFFECT OF STARCH SOURCE ON SOME ASPECTS OF RUMEN FERMENTATION IN SHEEP

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Introduction

It is well known that the starch fermentation rate in the forestomach of ruminants is different. The level of starch is important, too.

Materials and Methods

Six wethers with 60-65 kg liveweight were fitted with fistulae on the dorsal sac of the rumen. Two types of diets with different starch sources were compared: potatoes (P) and barley (B). Three levels of starch were tested: low (L), mean (M) and high (H) (table 1). The experiments consisted of adaptation periods (14 days) and experimental periods (12 days).

TABLE 1. DIETS (g)

Diets	Hay	DSPB[1]	P	B
PL	1100	160	432	
PM	918	133	1104	–
PH	607	93	2106	–
BL	1100	160		109
BM	918	133		273
BH	607	93	–	545

[1]DSPB – Dried sugar beet pulp

Results and Discussion

The concentration of hydrogene ions (pH) during the experiments was within the physiological ranges and ensured normal fermentation. The total quantity of VFA for diet BH before feeding and 2.5 h after feeding was higher ($p < .001$) compared to the same hours for pH diet (table 2). The reason for these results is the slower fermentation rate of potatoe-starch. With increasing the level of starch in the diet, the acetic acid (C_2) increased and the propionic (C_3) decreased for both P and B diets ($p < .05$).

TABLE 2. TOTAL CONCENTRATION OF VFA AND AMMONIA IN RUMEN CONTENT

After feeding h		Level of starch L	M	H
		VFA mmol/100 ml		
0	P	4.2^{bq}	5.19^{ap}	1.10^{bp}
2.5	P	6.53^{b}	7.28^{a}	1.92^{bp}
0	B	4.98^{bq}	6.23^{aq}	6.42^{q}
2.5	B	6.41^{b}	7.53^{a}	7.86^{q}
		NH_3 mg/100ml		
0	P	10.3^{bq}	12^{a}	9.4^{bq}
2.5	P	8.62^{bp}	17.5^{a}	19.1^{p}
0	B	12.5^{q}	13.1	12.1^{q}
2.5	B	12.7^{bq}	16.1^{a}	13.6^{bq}

^{a,b}Differences between groups are significant at $p < .05$ if the mean values have different letters comparing PL and PH to PM and BL and BH to BM.

^{p,q}Differences between diets are significant at $p < .05$ if the mean values have different letters comparing B to P.

The NH_3 concentration 2.5 h after feeding was lower for diet BH ($p < .001$) compared to diet pH and the same tendency was observed for diet BM in comparison with diet PM (table 2). Probably the utilization of NH_3 was better for rations with barley. These results were confirmed by the lower ($p < .001$) urea content in blood for BM and BH diets, compared to PM and PH diets (table 3).

The total protozoa number (table 4) for diet P increased ($p < .001$) with the increase in starch level, while in diet BM it was lowest ($p < .001$) when compared to diets BL and BH.

It was found that generous variability (table 5) was richer for the diet with barley compared to the diet with potatoes. The smaller generic number, together with the total protozoa number, was the reason for the lower cellulolytic activity

TABLE 3. BLOOD PARAMETERS (mg%)

	h		Level of starch L	M	H
		1	53.7^{b}	46.1^{ap}	41.3
P	2.5	2	174^{p}	174^{ap}	217^{bp}
		3	31.8^{b}	40^{ap}	36.7^{p}
		1	48.3^{b}	56.2^{aq}	48.6
B	2.5	2	211^{bq}	132^{aq}	174^{bq}
		3	34.8^{b}	26.8^{aq}	28.3^{q}

a,b,p,q As in table 2
P,B – As in table 2
1 – Blood sugar
2 – Alkali reserves
3 – Urea

in diet PL ($p < .001$) (table 4). Our experiments with predominate protozoa, Entodinium, had the same results reported Schwartz and Gilchrist (1975) with cattle and sheep fed grains- and molasses-based diets.

In the present experiment a comparatively constant level of Holotricha for both diets was found. This was a reason to suggest that their turnover rate was too slow. Similar results were observed by Leng et al. (1986) for ruminants fed

TABLE 4. TOTAL PROTOZOA NUMBER (THOUSANDS/ML)

After feeding h		Level of starch L	M	H
0		239^{bp}	464^{ap}	682^{b}
2	P	185^{bp}	411^{ap}	429
4		152^{bp}	423^{ap}	396
7		152^{bp}	371^{ap}	379
0		527^{bq}	333^{aq}	585^{b}
2	B	376^{bq}	207^{aq}	439^{b}
4		388^{bq}	230^{aq}	332^{b}
7		303^{bq}	203^{aq}	356^{b}
		Cellulolytic activity, %		
24	P	6.6^{bp}	29.0^{ap}	22.7^{b}
24	B	45.8^{bq}	24.2^{aq}	21.2

a,b,p,q As in table 2
P, B – As in table 2

TABLE 5. GENETROUS CONTENT AND AVERAGE PROTOZOA NUMBER (%)

Protozoa		Level of starch L	M	H
	Entodinium	97.7	98.3	98.0
	Diplodinium	–	0.4	3.1
P	Ophryoscolex	–	–	–
	Isotricha	1.7	0.7	0.7
	Dasitricha	0.6	0.6	0.6
	Entodinium	94.7	94.3	91.1
	Diplodinium	0.4	0.9	2.2
B	Ophryoscolex	0.1	0.2	1.9
	Isotricha	4.1	4.0	2.4
	Dasitricha	0.7	0.7	2.4

P,B – As in table 2.

diets based on sugar cane. It was concluded that Holotricha were sequestered somewhere in the rumen and only after the appearance of food were they attached to the feed particles (Bauchop, 1980).

It is known that the higher concentration of alkali reserves is favourable for the carbohydrate metabolism. With the increase in starch level in diet pH was found an increase of the alkali reserves ($p < .001$). The same result but at a low starch level was observed for diet BL ($p < .001$) (table 3). Maybe this was a result of the different fermentation rate of potatoes and barley.

(Key Words: Starch, Rumen Fermentation)

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