

Effects of access time to feed and sodium bicarbonate in cows given different silages

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Introduction Animal performance is closely related to silage intake, which might be affected by access time to feed, silage fermentation quality or using neutralising agents. The aim of this study was to assess the effects of access time to silage or addition of sodium bicarbonate on silage intake, milk yield and milk composition in diets based on restrictively fermented acid-treated or extensively fermented enzyme-treated grass silage.

Materials and methods Sixteen Ayrshire cows were used in four (4 x 4) Latin square designs with four 3-wk periods of which the results of the last week were used. The treatments in squares 1 and 2 were 8 or 20 h free access either to acid treated (Acid) or enzyme treated (Enz) grass silage. Addition of NaHCO₃ 0 or 100 g/d and 0 or 200 g/d in concentrate (12.5 or 25 g/kg) with Acid or Enz silages were studied in separate squares 3 and 4. Results are presented over squares because treatment effects did not differ significantly between squares. The first cut timothy dominated (67%) grass was direct cut with a flail-harvester using either formic acid-based (800 g/kg HCOOH + 20 g/kg H₃PO₄, 4.8 l/t) or enzyme additive (cellulase + hemicellulase) and ensiled into bunker silos. A concentrate mixture (barley-oats-rapeseed meal-minerals: 430-430-100-40 g/kg) was given 8 kg/d and hay 1 kg/d. Digestibility of silages was determined with four wethers.

Results Acid and Enz silages contained dry matter (DM) 224 and 219 g/kg, crude protein 168 and 159 and neutral detergent fibre 529 and 484 g/kg DM, respectively. Both silages were well preserved: pH 4.03 vs 3.95, sugar 54 vs 19, lactic acid 37 vs 103, acetic acid 14 vs 27, butyric acid 0.1 vs 0 g/kg DM and NH₄-N 38 vs 68 g/kg N, respectively. Organic matter digestibility of Enz silage tended to be lower ($P<0.1$) than that of Acid silage (0.757 vs 0.740) mainly due to lower fibre digestibility (cellulose 0.814 vs 0.777, $P<0.05$). Longer access time to silage (20 vs 8 h) tended to increase silage intake with Acid (4%) and Enz (8%) silages but the effect on milk (2 or 3%), fat, protein and lactose yields was statistically insignificant. Sodium bicarbonate had no significant effect on silage intake or milk production parameters either with Acid or Enz silage. Instead, silage fermentation quality affected significantly silage intake and, consequently, milk, energy corrected milk (ECM), fat and protein yield and fat and protein content, being higher in cows given Acid than Enz silage. Milk coagulation was affected so that curd firmness time was shorter (K_{20} , 15.6 vs 19.5 min) and curd firmness better (A_{10} , 27.5 vs 24.0 mm) with Acid than Enz silage. No differences between treatments were found in milk energy output (MJ/d) per metabolisable energy (ME) intake (MJ/d), but efficiency of utilisation of dietary crude protein for milk protein production was better with Enz than Acid silage.

Table 1 Effect of access time or NaHCO₃ on silage intake and milk production in cows fed Acid or Enz silage

Access time / Additive	Intake		Yield					Milk composition			Utilisation	
	Silage	Conc.	Milk	ECM	Fat	Prot	Lact	Fat	Prot	Lact	Milk E/ Feed E	Milk N/ Feed N
	-----kg/d-----		-----g/d-----					-----g/kg-----				
8 h / Acid	10.6	6.8	22.8	26.4	1176	772	1128	51.6	33.8	49.4	0.393	0.274
20 h / Acid	11.0	6.8	23.2	26.4	1158	780	1158	49.8	33.6	49.9	0.387	0.272
8 h / Enz	8.6	6.9	21.5	23.6	1005	710	1087	46.7	33.1	50.6	0.398	0.295
20 h / Enz	9.3	6.9	22.2	24.3	1032	722	1133	46.5	32.7	51.0	0.392	0.286
SEM	0.25	0.06	0.44	0.42	24.3	14.0	22.6	1.16	0.23	0.20	0.007	0.005
8 h vs 20 h	$P=0.06$									*		
Acid vs. Enz	***		*	***	***	***		**	**	***		**
NaHCO ₃ /Additive	Significance * $P<0.05$, ** $P<0.01$, *** $P<0.001$											
- / Acid	11.9	7.0	25.2	28.1	1216	837	1256	48.6	33.4	49.9	0.390	0.271
+ / Acid	12.0	6.8	24.7	27.6	1198	819	1239	48.6	33.1	50.2	0.388	0.267
- / Enz	10.0	6.9	23.5	25.1	1053	762	1183	45.1	32.6	50.3	0.390	0.285
+ / Enz	9.8	6.9	23.5	24.9	1046	753	1184	44.9	32.3	50.5	0.395	0.289
SEM	0.14	0.05	0.43	0.44	20.0	11.9	23.5	0.53	0.20	0.19	0.007	0.004
NaHCO ₃ - vs +												
Acid vs Enz	***		**	***	***	***	*	***	**	$P=0.07$		***

Conclusions Access time to silage of 20 h compared with 8 h only tended to increase silage intake. Instead, silage fermentation quality affected significantly animal performance. Restricted silage fermentation resulted in higher silage intake and milk production than extensive fermentation. Sodium bicarbonate had no benefit for intake or milk production parameters.