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INDIGESTION IN YOUNG CALVES

V. THE INFLUENCE OF GRASS SILAGE AND FINE HAY

By

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LAKSESVELA, B., Å. OMMUNDSEN and T. LANDSVERK: *Indigestion in young calves. V. The influence of grass silage and fine hay.* Acta vet. scand. 1978, 19, 543—548. — In an experiment with 24 young calves, lasting 45 days, all were fed a high lactose milk replacer causing some diarrhoea. Eight calves received grass silage and 8 fine hay in addition, while 8 received no solid supplement to the milk replacer (NS). Somewhat more ($P < 0.05$) dry matter was ingested from silage than hay. Weight gain was similar on the 2 supplements and much greater ($P < 0.001$) than on NS. Both silage and fine hay reduced ($P < 0.01$) the frequency of diarrhoea, approximately to the same extent. Further, silage or hay gave higher pH ($P = 0.001$ and 0.02 , respectively) and less gram positive cocci and rods in the rumen fluid, better developed ruminal papillae and heavier ($P < 0.01$) empty reticulo-rumens than NS. Some calves fed silage had ulcers in the rumen, the same having occurred on fine hay in earlier experiments, but not in the present one. Altogether, the 2 roughages gave very similar results.

silage; fine hay; indigestion; calves

A previous paper in this series (*Laksesvela et al.* 1977) recorded experiments showing that fine hay significantly reduced the frequency of diarrhoea in young calves fed a high lactose milk replacer causing some diarrhoea. On the other hand, coarse hay significantly acted to the contrary. The calves ate more fine than coarse hay, and fine hay gave the best development of the rumen.

In practice, silage replaces hay to an increasing extent in the feeding of young calves as well as older cattle. The present paper reports an experiment in which grass silage and fine hay were compared in the same way as previously done with coarse and fine hay. Hitherto such an experiment has been lacking.

MATERIALS AND METHODS

Silage and hay

The silage consisted mainly of timothy, harvested when the first ears appeared, and preserved in a tower silo with 3.3 l 85 % formic acid per ton. The hay was made up of various grasses grown approx. 1000 m above sea level, and it was regarded as very fine. The composition of the 2 materials was assessed both by common, chemical analyses and a meticulous separation by hand into structural parts, viz. stem, leaves and ears. The figures are shown in Table 1.

Table 1. Composition of hay and grass silage, in % of sample (S) or dry matter (DM).

		Hay		Silage	
		S	DM	S	DM
Chemical					
Moisture	%	19.0	—	74.5	—
Crude protein	%	12.5	15.4	3.2	12.5
Fat	%	4.3	5.3	1.1	4.3
N-free extract.	%	41.5	51.2	11.4	44.7
Crude fibres	%	17.3	21.4	8.1	31.8
Ash	%	5.4	6.7	1.7	6.7
Acetic acid	%			0.8	3.1
Butyric acid	%			0.0	0.0
Lactic acid	%			1.7	6.7
Volatile N	%			0.018	0.076
pH				4.3	
Structural				Wet	Dried
Stem	%	26.6		29.7	31.1
Leaves	%	68.9		65.0	62.5
Ears	%	4.5		5.3	6.4

According to the analyses, and also by look and odour, the silage was of normal, good quality. The hay was more leafy and contained less stem and crude fibres than the silage, this hay being even finer than the best hays used in the previous experiments.

Calves and regimen

Throughout the experiment, which lasted 45 days, 24 male calves averaging 8.1 days of age and 41.9 kg, were all fed the high lactose milk replacer, which consisted of 41.4 % skim milk

powder, 14 % sweet whey powder, 30 % lactose, 13.3 % butter plus emulgators, vitamins and minerals. The calves were introduced over 3 days to the milk replacer, previously having been fed colostrum and whole milk.

Twelve days after introducing the milk replacer, 2 groups of 8 calves each received either silage or hay according to appetite, while another group of 8 received no supplement of solid feed. The latter regimen is designated NS. From the time of giving silage or hay to some calves, all 24 were offered an electrolyte fluid, up to a maximum of 5 l per head per day. Its composition and other particulars as to methods, including clinical and post-slaughter examinations have been described in previous papers (*Slagsvold et al. 1977, Laksesvela et al. 1977*).

RESULTS

Growth data, feed intake, diarrhoea and general health

Figures regarding the above-mentioned parameters are collected in Table 2.

Table 2. Growth data, average daily intake of hay, silage and electrolyte fluid (EF), and days with diarrhoea, averages per calf.

	Number of calves	Wt. gain kg over 45 days ¹	Carcass wt. kg ²	Daily intake during 33 days			Diarrhoea, days out of 45 d ³
				hay, g dry matter ⁴	silage, g dry matter ⁴	EF l	
No suppl. (NS)	8	6.8	27.7	—	—	2.96	14.3
Hay	8	15.5	31.2	276	—	3.30	3.0
Silage	8	16.3	31.1	—	353	2.35	3.5

- 1 Sign. of difference from No suppl. P < 0.001 for hay and silage.
 2 " " " " " " P < 0.05 " " " "
 3 " " " " " " P < 0.01 " " " "
 4 " " " " hay P < 0.05 " silage

The live weight gain was similar on silage or hay, but much greater ($P < 0.001$) than on NS. Likewise the carcass weights were greater on silage or hay ($P < 0.05$) than on NS.

The intake of dry matter from silage was greater (< 0.05) than from hay.

Electrolyte fluid was drunk in somewhat greater quantities on hay than on the 2 other regimens, but the differences were not significant ($P = 0.2-0.3$).

Diarrhoea was less frequent on hay or silage ($P < 0.01$) than on NS, the 2 samples of roughage appearing very similar in this respect.

General health of all calves was good apart from the occurrence of diarrhoea. No calves died.

Findings in the rumen fluid

Rumen pH values averaged 6.75 on silage, 6.6 on hay and 6.14 on NS, the latter being significantly lower than on silage ($P = 0.001$) or hay ($P = 0.02$). The difference between silage and hay approached significance ($P < 0.1$). The averages were rather stable throughout the experiment, though the single observations varied considerably, but in most cases between 6 and 7. One calf on NS had a remarkably low pH all the time, the values ranging between 4.65 and 5.4. Its rumen fluid contained curds the first 2 weeks.

Direct microscopy showed distinct variations in the bacterial picture. On NS, gram positive cocci dominated all the time together with some gram positive rods. In the calf with the very low pH values, large gram positive rods persisted in abundance. On silage and hay, gram positive cocci and rods dominated only in the beginning, the picture changing into a more heterogenous one as the intake of hay or silage increased. The 2 roughages sustained a similar bacterial flora.

Ciliates were found in calves on hay the last 2 weeks, while flagellates were common on all diets. Also epithelial cells occurred on all diets, but always in moderate amounts.

Post slaughter findings in the digestive tract

Empty reticulo-rumens were heavier ($P < 0.01$) on silage or hay than on NS. Heights of the ruminal papillae in atrium ruminis averaged 3.7 mm on silage, 3.8 mm on hay, but less than 0.5 mm and hardly measurable on NS by the employed method.

Silage gave a greyish black, hay a yellowish brown and NS a whitish yellow ruminal mucosa. Four calves on silage had 1—2 ulcers, 1—3 mm in diameter, situated at the cranial and caudal rumen pilae. Macroscopically, other features of the forestomachs were normal, except that the calves on NS had underdeveloped rumens with bezoars, and the one with low pH had also extensive ruminal hyperkeratosis.

Stereo-microscopy showed that silage or hay gave well-deve-

loped, leaf to tongue-shaped papillae. Although shorter, the papillae in the ventral rumen sac showed no different shape from those in atrium ruminis. The NS fed calf with hyperkeratosis had nodular papillae on mucosal ridges.

According to histological examinations, the ruminal sections of all calves were normal, except the single case with hyperkeratosis and microabscesses in 2 of the calves which had ulcers.

DISCUSSION

In the short term experiment reported here, it was not possible to assess whether silage or hay promoted the live weight gain equally much or not. A slight and insignificant difference in favour of silage came up in the end, and it may perhaps have been the start of a trend, since the calves ingested more dry matter from silage than hay.

The silage consisted of somewhat coarser material than the hay. Despite that, the silage counteracted the lactose-induced diarrhoea approximately to the same extent as hay. As regards hay the results coincided with previous findings with fine hay, both in this and other respects (*Laksesvela et al. 1977*).

Low pH and hyperkeratosis in the rumen go together (*Kay et al. 1969*), and this was the case also in 1 calf on NS in the present experiment. These phenomena have not occurred on the same kind of diet in previous experiments (*Laksesvela et al.*), and the question is posed whether the liquid diet may have fermented in the particular calf, following overflow of the reticular groove.

Silage was accompanied by some cases of ruminal ulcers, while hay or NS were not. The question may arise whether the acidic character of silage could have favoured development of such lesions, since feeding much barley results in more ruminal ulcers and scars; being thought to do so because it gives rise to acidic fermentation and reduced pH in the rumen fluid (*Fell et al. 1968, Kay et al.*). Feeding silage, however, if anything, resulted in an elevated pH in the rumen fluid. Ruminal ulcers and scars are common in young calves, incidences having occurred in the previous experiments when feeding coarse or fine hay, with or without barley (*Slagsvold et al. 1977, Laksesvela et al.*). *Groth & Berner (1971)* have suggested that 95 % of all calves may get such lesions. It would thus not be fair to brandmark good silage unequivocally as a less wholesome feed for young calves than fine hay.

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SAMMENDRAG

Indigestion hos unge kalver. V. Virkningen av grassilofór og fint høy.

I et forsøk over 45 dager med 24 unge kalver fikk alle en laktoserik mjølkeerstatning som ga en del diaré. Åtte kalver fikk i tillegg grassilofór og 8 fint høy, mens 8 ikke fikk noe tilskudd av fast føde til mjølkeerstatningen.

Kalvene tok opp mer tørrstoff ($P < 0,05$) fra silofór enn fra høy. Vektøkningen var omlag lik på de to slags tilskudsfor og mye større ($P < 0,001$) enn når det ikke ble gitt tilskudd. Både silofór og høy reduserte ($P < 0,01$) hyppigheten av diaré, omlag like mye.

Ellers ga silofór og høy høyere pH ($P =$ henholdsvis 0,001 og 0,02), mindre av gram-positive kokker og staver i vomsaften, bedre utvikling av vompapillene og større ($P < 0,01$) vekt av nettnage og vom renses for innhold, sammenliknet med intet tilskudd. Enkelte kalver gitt silofór hadde sår i vomma, noe som også har forekommet i tidligere forsøk med fint høy, men ikke i dette siste. Alt i alt ga de to slags grovfór meget like resultater.

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