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## Ruminal and post-ruminal digestion of starch from 2 types of concentrates in the young calf during and after weaning

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Abrupt weaning of young calves from milk to concentrate led to rapid development of rumen and starch digestion (Leibholz, 1978). We report data obtained using progressive weaning, a more common rearing method in France.

Eleven duodenal and ileal-fistulated Friesian calves were weaned by reducing and then suppressing starch-free skim milk by wk 7 and 10 respectively (Lallès and Poncet, 1990). Solid diets fed from wk 7 were based on hay (20%) and concentrate (80%). The latter contained either pea (71%, A) or soyabean meal (29%, B) mixed with maize starch (19 and 59%) in order to obtain similar starch contents (53 and 57% on a DM basis). Starch digestion in the rumen, small and large intestine was studied during (wk 9–10) and twice (wk 15–16 and 19–20) after weaning, as described earlier (Lallès and Poncet, 1990).

Starch was almost totally digested by 3 wk after commencement of dry feeding (table

1). It was mainly degraded in the rumen, as observed by Leibholz (1978). However more starch from diet A containing pea reached the duodenum, presumably because of its different botanical origin and/or processing. Starch apparent digestibility in the small intestine was similar for both diets (0.77). It was, however, lower than that of barley (Leibholz, 1978). Limited amounts of starch were digested in the large intestine.

*In conclusion*, progressive weaning of calves did not consistently modify the pattern of starch digestion which is mainly located in the rumen. Starch from the pea-containing diet appeared to be less degraded in the rumen than maize starch.

Lallès JP, Poncet C (1990) *Livest Prod Sci* 24, 129-142

Leibholz J (1978) *Aust J Agric Res* 29, 1293-1299

**Table 1.** Starch intake, apparent digestibility in total gut and contribution (%) of main compartments in the calf

Concentrate type (observations)	9–10 (weaning)		Calf's age (wk)				Residual SD
	A (6)	B (5)	15–16		19–20		
			A (6)	B (5)	A (6)	B (5)	
Starch intake (g/d) <sup>a</sup>	333	356	601	682	987	1015	15.3
Apparent digestibility (%)	99.4	99.5	99.4	99.5	99.1	99.4	0.06
Rumen <sup>b</sup>	90.9	91.6	88.3	94.3	89.6	93.3	0.49
Small intestine <sup>b</sup>	7.7	7.4	8.6	4.0	8.9	6.1	0.43
Large intestine <sup>a,b</sup>	1.4	1.0	3.1	1.7	1.6	0.5	0.17

## Straw feeding value in sheep and goats: effect of energy and nitrogen supply

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Previous studies have shown that goats utilize nitrogen-deficient diets better than sheep (Tisserand *et al*, 1991). In order to complete this work, we compared different types of straw complement (maize grain or molasses) given alone or with the addition of urea.

The experiment was conducted on 12 adult castrated rams and 12 adult castrated bucks (6 animals from each species equipped with a permanent rumen cannula). Over a 5-wk period, all the animals were successively given *ad libitum* the following 4 diets: 1) molassed (20%) chopped wheat straw (92.2% organic matter (OM), 5.4% crude protein (CP), 37.1% crude fiber (CF) in DM); 2) chopped wheat straw + 190 g grain maize per kg straw (93.7% OM, 4.0% CP, 38.3% CF); 3) molassed chopped wheat straw + 6% urea (94.4% OM, 15.6% CP, 35.1% CF); 4) chopped wheat straw + 6% urea + 190 g grain maize per kg straw (93.4% OM, 13.6% CP, 34.8% CF). Additional experimental details have been presented in Arista (1991).

Table I shows that goats ingest the 4 diets and more particularly the molassed straw

better than sheep. Nevertheless, their OM digestibility measured on d 10 was slightly higher, at least when low nitrogen diets (1 and 2) were fed. The volatile fatty acid (VFA) concentration in rumen fluid was higher in the maize grain-straw diet in both species. Molassed straw feeding resulted in higher VFA levels in goats as compared to sheep, in agreement with the higher quantity of OM digested.

*In conclusion*, addition of urea increases rumen ammonia level. Statistical treatment (Arista, 1991) showed that goats, perhaps due to their selection ability, use the nitrogen-deficient molassed straws better than sheep and seem to take better advantage of a urea complement of a corn + straw diet than of a molassed straw diet.

Arista E (1991) Thèse de Doctorat, Université de Bourgogne, 155 p

Tisserand JL, Hadjipanayiotou M, Gihad ED (1991) *Goat Nutrition* (Morand-Fehr, P, ed) Pudoc, Wageningen, 46-60

**Table I.** Intake, OM digestibility (12 animals) and VFA and NH<sub>3</sub>-N concentrations (6 animals) in rumen liquid in sheep (S) and goats (G).

	DM intake (g/kg LW <sup>0.75</sup> )		DOM (%)		VFA (mmol/l)		NH <sub>3</sub> -N (mg/l)	
	S	G	S	G	S	G	S	G
1) Molassed straw	24.0	33.0*	47.9	53.0	35.0	44.5	44.0	48.0
2) Straw + maize	37.0	39.5	47.0	52.9	63.0	55.0	44.5	59.0
3) Molassed straw + urea	37.5	46.0*	51.5	49.0	84.0	76.5	261.5	246.5
4) Straw + urea + maize	37.6	51.5*	59.0	56.5	93.0	90.0	259.0	261.5

\* Significantly higher ( $P < 0.01$ ) than in sheep.