

There are good reasons to feed high concentrate, low fibre diets to lactating cows. Increased production per cow is more efficient; reducing dietary fibre lowers fat test and increases protein production. But cows fed highly fermentable diets are at greater risk of rumen acidosis—the rapid production of acid by rumen microbes which lowers rumen pH. Unless this drop in pH can be controlled, fibre digestion is compromised, microbial growth is depressed and the cow may go off feed.

Rumen pH is primarily controlled by the secretion of salivary buffers which blunt the pH-lowering effect of fermentation acids. Estimates of saliva production by the lactating cow have ranged from 200 to 300 litres/day. Total daily saliva secretion is strongly influenced by the amount of time the cow spends eating and ruminating.

Current studies at the Lethbridge Research Centre are aimed at determining how to increase saliva production in cows on low fibre diets to minimize the risk of acidosis. In an experiment completed recently, cows were fed total mixed rations (TMRs) containing 40, 50 or 60% forage or a fourth diet where equal amounts of concentrate and forage were offered separately (FS). Concentrates were barley-based and forage was barley silage. Results are summarized on the right.

There were no significant differences in dry matter (DM) intake or milk production among the four diets. High production levels were not expected since all cows were prepared with rumen fistulas and their rumens were routinely emptied to measure saliva production. Among the cows fed TMRs, higher forage levels produced higher milk fat tests. FS cows had lower fat tests than cows fed the same proportion of forage in the form of a TMR.

Diet Affects Chewing and Salivation

Cows fed forage and concentrates separately (FS) spent less time chewing while eating than the cows fed TMRs. Although the FS cows spent as much time ruminating as the cows fed the 60% forage TMR, total chewing time was greater for all TMR-fed cows and increased with the level of forage in the diet. TMR cows also produced more saliva while eating than the FS cows although no significant differences were seen in total saliva production. However, the saliva produced while eating has a critical role in buffering the acids produced immediately after feed consumption. This is the time when rumen pH depression is most likely to occur.

Another important observation is the difference in saliva produced during the consumption of forage versus concentrate by the FS cows. Although a large amount was secreted while consuming their barley silage (4.43 ml/gram of DM), only 1.19 ml/gram were produced while consuming their concentrate, leaving the cow vulnerable to severe pH depression due to rapid production of fermentation acids after ingestion of a concentrate meal.

source: M. Maekawa et al., J Dairy Sci 83(suppl 1):263(2000)

	----- TMRs -----			FS
	----- Forage % -----			
	40	50	60	50
Dry matter intake, kg/day	18.0	18.6	17.7	18.5
3.5% Fat-corrected Milk, kg/day	27.4	28.7	28.4	27.5
Milk fat concentration, %	3.48	3.80	3.93	3.48
Chewing while eating, min/day	243	241	264	198
Chewing while ruminating, min/day	498	516	584	584
Total chewing time, min/day	741	757	848	736
Saliva production, litres/day				
While Eating	51.6	59.9	54.3	45.1
While Ruminating (estimate)	108.2	112.1	126.9	126.9
While Resting	73.1	68.2	52.7	72.0
Total	232.9	240.2	233.9	244.0
Salivation rate while eating, ml/min				
TMR - forage + concentrate	210	196	246	
FS - forage				253
FS - concentrate				221
Ensalivation, ml/gram of dry matter				
TMR - forage + concentrate	2.97	2.99	3.57	
FS - forage				4.43
FS - concentrate				1.19