

Effect of double-muscling and of removing straw, fed besides concentrates, on the chewing behaviour of bulls*

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ABSTRACT

To determine if beef bulls adjust their chewing pattern to avoid ruminal acidosis, the chewing behaviour of double-muscled (dm) and non-dm bulls was studied with a concentrate based diet, with and without straw. The conformation (dm or not) had no influence on chewing behaviour. The removal of the straw resulted in an importantly increased DM-intake. When fed 100% concentrates, significant rumination activity was recorded. Removing the roughage from the diet had no influence on time of eating, but induced a slight shift towards relatively more rumination during the second half of the day.

KEY WORDS: chewing behaviour, concentrates, double-muscling, bulls, ruminal acidosis, straw

INTRODUCTION

The ability of ruminants to control feed intake is long known. Chase et al. (1976) stated that steers can vary the size or the number of meals to control feed intake. If bulls adjust their eating and ruminating pattern to avoid ruminal acidosis when physical structure supply is marginal, is unknown. E.g., bulls could reduce the acid load for the rumen by shifting rumination more towards the time that the acid load is highest. The extra amount of saliva produced during rumination would then give additional buffer capacity to the rumen (Okamoto, 1976). By spreading the meals over the total day period, rumen acid load could also be reduced.

Chewing behaviour was studied with a concentrate based diet, with and without straw. By using double-muscled (dm) and non-dm bulls the influence of

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the conformation on chewing behaviour was investigated. The bulls dm have a different intake capacity (Fiems et al., 1997). However, if they also have a different eating pattern was never investigated.

MATERIAL AND METHODS

During the first week 12 Belgian Blue bulls (6 dm and 6 non-dm; ± 18 months) were fed 12% straw (NDF content: 71% of DM) and 88% concentrate (C; NDF content: 38% of DM) (DM-basis). After that week, the dietary roughage part decreased slowly each week until 100% C was fed, 4 weeks later. The structural value of the straw and the C, calculated according to De Brabander et al. (1999), amounted to 4.30 and 0.27 per kg DM. The mixed rations were fed individually to appetite in one meal at 9.00 a.m. The grains in the C were rolled, other ingredients remained unground. The animals were tied, had individual mangers and free access to water. Wood shavings were used as bedding. During the 5th, 6th and 7th day of the first (12% straw) and last week (100% C) chewing behaviour was recorded using a head-halter recording chewing movements digitally. For each day the number of periods and the time spent eating, ruminating and idling was calculated. Data were divided into 24 h periods and for each hour, the time spent eating, ruminating and idling was expressed in min and as % of the total daily eating, rumination and idling time.

RESULTS AND DISCUSSION

The 12 bulls weighed 609 ± 50 kg during the 12% straw week and 632 ± 47 kg during the 100% C week. Intake and chewing parameters are listed in Table 1.

Table 1 Intake and chewing parameters for diets based on C with 12% or 0% straw

Conformation		Non-dm		dm		SEM	P-value	
		12	0	12	0		Dm/	%
Portion of straw, %		12	0	12	0		non-dm	straw
Number of animals		6	6	6	5*			
Intake	kg DM/day	8.4	10.2	7.1	9.8	0.3	0.06	<0.001
	MJ NE/day	58.8	78.4	49.9	70.7	1.9	0.07	<0.001
	g DM/kg LW ^{0.75}	67.4	79.6	58.6	79.7	2.2	0.13	<0.001
	g NDF/kg LW ^{0.75}	28.5	30.4	24.8	30.5	0.7	0.10	<0.01
Eating	periods/day	19.4	20.5	17.7	17.3	0.9	0.18	0.86
	min/day	179	151	166	141	7	0.35	0.044
	min/kg DM	21.5	15.4	24.4	14.4	1.2	0.59	<0.001
Rumination	periods/day	15.9	8.8	16.1	10.4	0.9	0.51	<0.001
	min/day	506	209	463	167	40	0.39	<0.001
	min/kg DM	60.6	19.3	67.7	16.9	5.5	0.65	<0.001

* during the trial 1 dm bull showed signs of acute acidosis and was removed from the trial

Effect of conformation

There was no effect of conformation on any of the parameters measured. There was a tendency for the intake to be lower in dm compared to non-dm bulls. This tendency was most pronounced ($P=0.06$) when the intake was expressed in DM. Thus, no indications were found of an influence of the conformation on the chewing behaviour.

Effect of removing straw

Daily DM and energy intake of the 100% C was, respectively, 23 and 27% higher than for the diet with straw. This indicates that 12% straw strongly reduced *ad libitum* intake. This was most pronounced for the dm bulls (28 vs 18% for the DM-intake). Due to this increased DM-intake, NDF intake was higher for the 100% C diet. Despite the higher intake for the 100% C, the number of meals was not influenced. The time spent eating, however, decreased on average by 15%. There was a much greater decrease in the number and the duration of rumination periods. However, it is quite surprising that even at 100% C, bulls spent 188 min ruminating daily or about 18 min per kg DM of C.

In contrast to earlier studies with cows fed 100% C (grain-based) diets where regular mastications were seldom seen (Freer and Campling, 1965), in this experiment several periods of rumination were recorded at 100% C. Probably, the high amount of pressed sugar beet and citrus pulp in the C (total 44%) caused the extra rumination time. De Brabander et al. (1999) found that Holstein cows eat and ruminate on average 7.7 and 14.0 min per kg DM of dried sugar beet pulp, whereas the rumination time for cereals is mostly considered negligible.

Hourly chewing pattern

Only small differences existed between the diets in eating and rumination activity over a 24-h interval (Figure 1). Eating took place in the first 12 h postprandial. The most important meal was recorded during the first h after feeding, since between 17 and 23% of total eating time occurred in that period.

The presence of 12% straw in the ration increased the eating time by about 14 min in the first h after feeding. Removing the straw, reduced the rumination time in the first half of the day from 40 to 30%. At the same time, no important shift in relative eating time was found. The moderate shift towards more nocturnal rumination implies that total chewing time during the first half of the day (when by far the largest part of the feed is eaten and the acid load for the rumen is highest) is relatively lower for the 100% C diet. These results indicate that the bulls did not adapt their chewing pattern to improve the buffering capacity of the rumen at the time the ruminal acid load was highest.

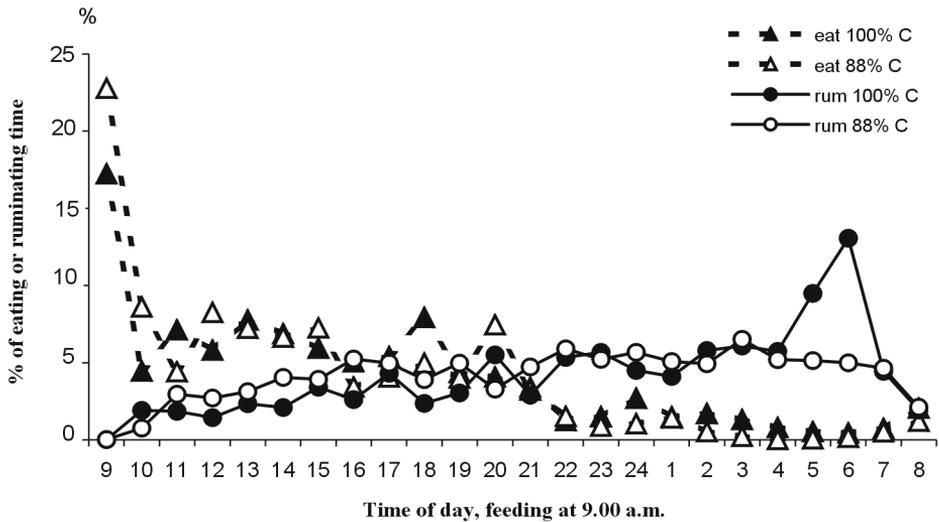


Figure 1. Percent of the daily eating (eat) or ruminating (rum.) time spent during each hour of the day (h postprandial) for diets with 100 or 88% C

CONCLUSIONS

The conformation of the animal had only limited influence on chewing behaviour. The removal of the straw resulted in an importantly increased DM-intake. Even when the concentrate was fed at 100%, significant rumination activity was recorded. Removing the roughage had no influence on eating pattern, but induced a shift towards relatively more rumination during the night period. This indicates that bulls did not adapt their chewing pattern to improve the buffering capacity of the rumen at the time of the highest ruminal acid load.

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