Relationship Between the Incidence of Displaced Abomasum and Feeding of Cows in Tokachi District, Hokkaido, Northern Japan

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ABSTRACT : In order to investigate the relationship between the incidence of displaced abomasum and feeding, the actual feeding practices and chemical compositions of roughage were examined in 2 kinds of farms at Tokachi district in Hokkaido. Examination of animal health records revealed that the annual milk yield per cow in high incidence (H-DA) farms was significantly higher than that in low incidence (L-DA) farms. The amount of concentrates fed in H-DA farms tended to be higher than that in L-DA farms during lactation. Compared to L-DA farms, the amount of juicy roughage (corn silage and grass silage) and dry roughage (hay, hay cube and roll wrap silage) during lactation in H-DA farms tended to be higher and lower, respectively. Moreover, the amount of roughage and the ratio of roughage to concentrates in H-DA farms tended to be lower than in L-DA farms. The survey indicated that displaced abomasum was associated with insufficient feeding of dietary fiber and overfeeding of concentrates. *(Asian-Aust. J. Anim. Sci. 2001. Vol. 14, No. 1 : 88-91)*

Key Words : Displaced Abomasum, Feeding Management, Lactation, Roughage, Concentrate

INTRODUCTION

Improved nutrition and genetics has resulted in larger dairy cows with increased milk yield. This has placed a strain on the physiology of the cow, leading to an increase in production-related diseases (Radostits et al., 1994), and greater awareness of appropriate management practices. Taguchi et al. (1991) reported that the combination of a nutritional deficiency in the late dry period and a change to a production diet after parturition is a causative factor in displaced abomasum (DA). In the present study, the authors examined the relationship of the feeding practices of the lactating dairy cow to the occurrence or non-occurrence of DA in the Tokachi district of Hokkaido, and attempted to investigate the cause of DA in relation to feeding management.

MATERIALS AND METHODS

From April to October in 1999, based on the disease diagnosis and treatment records of the past six years in the Tokachi agricultural mutual aid union, farms were divided into 2 groups based on the frequency of incidence of DA. H-DA farms (high incidence) had a >5% DA incidence (number of DA cases/total number of breeding cows$\times$100) and L-DA farms (low incidence) had <5% DA incidence. The following data were recorded on feeding practices from a total of 40 farms: 1) the current numbers of breeding cows and heifers; 2) the size of the land areas planted with grass and dent corn; 3) kind of the diet; 4) diet composition of roughage harvested in 1998; 5) incidence of DA in 1997 and 1998 fiscal year (investigated in the domestic animal clinic in each town and village); and 6) the average milk yield of each farm in 1998 fiscal year and the butterfat percentage (investigated in the Dairy Cow Authorization Society).

Chemical composition of the corn silage, the grass silage and the roll wrap silage for each farm were analyzed according to the standard methods (Sagawa et al., 1999). Organic cellular contents (OCC) and organic cell wall substances (OCW) were analyzed according to the enzyme method (Abe, 1988).

The Student's t-test was used to compare each region's general management conditions, chemical composition of the silage, and the dry matter percentages and ratios of feeds. Data on percentages and ratios were transformed prior to analysis.

RESULTS

General management conditions in H-DA and L-DA farms are shown in table 1. The number of cows, number of heifers, and area of grassland per cow in H-DA farms tended to be higher than those in L-DA farms. Area planted with dent corn, annual average milk yield, incidence rate of DA in 1997 and 1998 fiscal year in H-DA farms tended to be higher than those in L-DA farms.

Chemical composition of silage in H-DA and

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Table 1. General management conditions in H-DA (frequent occurrence of displaced abomasum) and L-DA farms (non-frequent occurrence)

General management conditions	H-DA farms	L-DA farms	Pooled SE
Number of farms	20	20	
Number of cows (head)	81.1	69.9	7.9
Number of heifers (head)	81.7	39.0	12.3
Area of grassland (ha)	39.6	32.5	3.2
Area of grassland per cow (ha)	0.5	0.6	0
Area planted with dent corn (ha)	14.7[a]	8.0[b]	1.4
Area planted with dent corn per cow (ha)	0.2	0.2	0
Annual average milk yield (kg/head)	9538[a]	7941[b]	170.0
Butter fat percentage (%)	3.9	3.9	0
Incidence rate of DA in 1997 fiscal year (%)	10.2	2.1	0
Incidence rate of DA in 1998 fiscal year (%)	11.1	2.7	0

1) Pooled SE: standard error of data from all farms (H-DA and L-DA farms).
2) Significant difference ($p<0.01$ or $p<0.05$) between a and b.
3) H: high, L: low, DA: displaced abomasum.

Table 2. Chemical composition of silage in H-DA (frequent occurrence) and L-DA farms (non-frequent occurrence)

Silage	Type of farm	No. of samples	Water content (% of original)	Chemical composition (% of dry matter)							
				TDN	Crude protein	Crude fat	Crude ash	ADF	NDF	OCC	OCW
CS	H-DA	20	73.0	64.0	9.6	3.3	4.7	28.7	51.2	42.9	51.2
	L-DA	20	73.0	63.6	9.3	3.1	4.7	29.9	53.4	39.5	53.3
	Pooled SE		0.6	0.5	0.2	0.1	0.1	0.7	1.1	1.2	1.2
GS	H-DA	20	70.4	56.7	12.4	4.5	7.7	25.8[a]	61.1[a]	27.5	59.4[a]
	L-DA	20	70.7	56.2	11.7	4.6	7.0	38.5[b]	65.6[b]	24.5	67.3[b]
	Pooled SE		1.2	0.5	0.4	0.1	0.2	0.6	0.9	1.0	1.4
RS	H-DA	20	36.8	55.0	8.7	4.0	6.2	37.5	64.4	27.1	65.4
	L-DA	20	38.8	54.1	10.2	4.5	7.5	40.0	68.1	20.5	69.4
	Pooled SE		4.2	0.5	0.7	0.5	0.3	1.0	1.5	2.1	1.6

1) Pooled SE: standard error of data from all farms (H-DA and L-DA farms).
2) Significant difference ($p<0.01$ or $p<0.05$) between a and b.
3) CS: corn silage, GS: grass silage, RS: roll wrap silage.

L-DA farms are shown in table 2. Differences in water content, TDN, crude protein, crude fat and crude ash for 3 kinds of silage were not seen between H-DA and L-DA farms. However, ADF, NDF and OCW of silage in H-DA farms tended to be lower than those in L-DA farms and OCC tended to be higher.

The percentages eaten of the different kinds of feed (as dry matter) in the different stages of lactation in H-DA and L-DA farms are shown in table 3. The percentages of the corn silage and the grass silage in H-DA farms tended to be higher than those in L-DA farms through all stages of lactation. Moreover, the percentages of the roll wrap silage, hay, hay cube and beet pulp in H-DA farms tended to be lower than those in L-DA farms through all stages of lactation and the dry period. The percentage of concentrates in H-DA farms tended to be higher than that in L-DA farms at all stages of lactation but not in the dry period. No significant difference in total feed intake (DM) was seen between H-DA and L-DA farms through all stages of lactation and dry period. The ratio of roughage to concentrates tended to be lower in H-DA farms during all stages of lactation but not in the dry period.

The percentages of the different kinds of roughage in total roughage in H-DA and L-DA farms are shown in table 4. The percentages of the corn silage and the grass silage to total roughage in H-DA farms tended to be higher than in L-DA farms. The percentages of the roll wrap silage, hay and hay cube in total roughage in H-DA farms tended to be lower

Table 3. The percentages of different kinds of feed fed (dry matter basis) during the 3 stages of lactation and the dry period in H-DA (frequent occurrence of displaced abomasum) and L-DA farms (non-frequent occurrence)

Stages of lactation & dry period	Type of farm	No. of samples	Percentages of different kinds of feed fed as dry matter (%)								TF (kg)	R/C
			CS	GS	RS	H	HC	BP	C	OT		
Early stage	H-DA	20	19.4	23.1	1.7	2.1[a]	0.3	8.7	38.4[a]	6.3[a]	18.3	1.4[a]
	L-DA	20	16.9	15.0	4.9	11.7[b]	3.1	9.6	27.4[b]	11.4[b]	17.9	2.2[b]
	Pooled SE		1.1	1.8	0.2	0.3	0.1	0.2	0.4	0.3	0.7	0.2
Middle stage	H-DA	20	17.6	20.9	1.5	1.7[a]	0.3[a]	8.5	43.9	5.6[a]	21.2	1.2
	L-DA	20	15.2	12.7	4.4	9.7[b]	3.4[b]	9.2	34.8	10.5[b]	21.1	1.6
	Pooled SE		1.2	1.8	0.8	0.3	0.1	0.2	0.5	0.3	0.8	0.2
Latter stage	H-DA	20	18.9	22.9	5.4[a]	3.3[a]	0.2[a]	7.5	37.3[a]	4.5[a]	18.6	1.6
	L-DA	20	14.9	16.5	18.8[b]	10.1[b]	2.7[b]	7.6	19.6[b]	9.7[b]	19.7	3.6
	Pooled SE		1.1	1.8	0.8	0.3	0.1	0.2	0.5	0.2	0.7	1.6
Dry period	H-DA	20	19.6	34.4[a]	3.9	12.9	0	2.2	23.0	4.0	10.8	3.2
	L-DA	20	13.9	15.5[b]	13.4	17.6	1.2	5.0	28.5	5.0	8.1	2.3
	Pooled SE		0.9	1.5	1.0	0.6	0.1	0.2	0.2	0.2	0.9	0.6

1) Pooled SE: standard error of data from all farms (H-DA and L-DA farms).
2) Significant difference ($p<0.01$ or $p<0.05$) between a and b for the transformed values.
3) CS: corn silage, GS: grass silage, RS: roll wrap silage, H: hay, HC: hay cube, BP: beet pulp, C: concentrates, OT: others, TF: total feed, R/C: ratio of roughage (CS+GS+RS+H+HC+BP) to concentrates (C).

Table 4. The percentages of different kinds of roughage to total roughage in H-DA (frequent occurrence) and L-DA farms (non-frequent occurrence)

Roughages	H-DA farms (n=20)	L-DA farms (n=20)	Pooled SE
CS/TR (%)	39.1	31.0	3.3
GS/TR (%)	38.1	19.8	3.6
RS/TR (%)	4.7	15.6	3.6
H/TR (%)	3.7[a]	15.6[b]	1.9
HC/TR (%)	0.6[a]	4.4[b]	1.1
BP/TR (%)	13.8	13.6	2.1
TR (kg)	13.5	15.7	1.3

1) n=no. of samples.
2) Pooled SE: standard error of data from all farms (H-DA and L-DA farms).
3) Significant difference ($p<0.01$ or $p<0.05$) between a and b for the transformed values.
4) Values were based on dry matter feed.
5) Total roughage (TR): the part of the feed excluding the concentrates and others.
6) CS: corn silage, GS: grass silage, RS: roll wrap silage, H: hay, HC: hay cube, BP: beet pulp.

than in L-DA farms.

DISCUSSION

DA is thought to be caused by multiple factors including high production, heavy concentrate feeding, type of housing, limited exercise in late pregnancy and the stress of parturition (Radostits et al., 1994). Overfeeding of concentrates before and after parturition is thought to contribute by decreasing fiber intake thereby decreasing the salivation and buffering in the rumen. Abomasal atony is induced by rumen acidosis, and DA may be induced (Coppock, 1974; Grymer and Hasselholt, 1980). However, even with excessive intake of concentrates, DA may be prevented if the homeostasis of the rumen fermentation is maintained by sufficient intake of appropriate fiber (Curtis et al., 1985). However, DA continues to occur and information on feeding practices for prevention is limited. The combination of a low feed intake in the late dry period and a change to a lactating diet after parturition is suggested to be a causative factor in this disease (Taguchi et al., 1990). In this paper, we paid attention to differences in the feeding management during the entire lactating stage, and compared the feeding practices over the entire lactating stage and dry period in the H-DA and L-DA farms in Tokachi district of Hokkaido.

Significant differences were not seen in the chemical composition of 3 kinds of silage between H-DA and L-DA farms, but ADF, NDF and OCW in H-DA farms tended to be lower than those in L-DA farms. The fiber of 3 kinds of silage in H-DA farms of DA tended to be lower than in L-DA farms, and it is suggested that the higher incidence in H-DA farms is due to feeding lower fiber diets even though the nutritional contents are still comparable to that of L-DA farms. ADF and NDF of corn silage are reported to be low by early reaping time (Wilkinson

and Phipps, 1979). In addition, NDF has a high correlation with rumination action (Welch, 1982), and ADF has a high correlation with length of cut silage (Ruppel, 1993). It was suggested that the decreased ADF and NDF in the corn silage and the grass silage reflect shortening the length of cut silage and earlier harvesting.

During the period shortly before and after parturition, overfeeding of concentrates decreases dry matter intake of dairy cows, and crude fiber requirements are not fulfilled (Grymer and Hasselholt, 1980; Grymer et al., 1981). Concentrates were a greater proportion of intake in H-DA farms than L-DA farms ($p<0.05$), and consequently total roughage intake was lower in H-DA farms than L-DA farms. In addition, the proportion of juicy roughage (corn silage and grass silage) was higher and dry roughage (hay, hay cube and roll wrap silage) was lower in H-DA farms than L-DA farms during lactation.

These results show that the H-DA farms have higher milk yields, higher concentrate intakes and lower roughage:concentrate ratios than L-DA farms. They also show that the roughage from H-DA farms has lower NDF than that from L-DA farms. In consequence, insufficient feeding of dietary fibers and overfeeding of concentrates were thought to induce the DA. Therefore, to reduce the incidence of DA, the feeding practices should be manipulated in such a way that dietary fibers are fed in sufficient amounts and concentrates are limited but not to the extent that nutritional requirements are not met and so affect milk production. For the criteria to avoid DA, more than 17.7% crude fiber, 21% of ADF and 28% of NDF should be contained in the dairy ration. Additionally, 75% of total NDF requirement is recommended to be supplied from roughages. It is to be noted that feeding management alone may not be able to significantly reduce DA if other contributing factors such as type of housing and stress of parturition are not properly managed.

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