Prevalence of subacute ruminal acidosis in some dairy herds of Khorasan Razavi province, northeast of Iran

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(Received 26 Jan 2008; revised version 2 Sept 2008; accepted 17 Nov 2008)

Summary

To estimate the prevalence of subacute ruminal acidosis (SARA) in dairy cows, a total of 196 ruminal fluid samples were drawn by rumenocentesis from 10 dairy herds of Khorasan Razavi province, northeast of Iran. Two groups of 12 cows, early lactation and mid-lactation cows were sampled in each dairy herd and ruminal pH was determined immediately using a portable pH-meter. A total of 54 cows (27.6%) were found to be experiencing SARA. No significant differences were found between SARA affected and non-affected cows in ruminal contractions, faecal quality and fat and protein components of milk.

Key words: Subacute ruminal acidosis, Dairy herds, Iran

Introduction

Subacute ruminal acidosis (SARA) is characterized by daily episodes of low ruminal pH between 5.5 and 5.0 (Krause and Oetzel, 2006). This digestive disorder is the consequence of feeding high grain diets to dairy cows, which are adapted to digest predominantly forage diets (Oetzel, 2003). The depression of ruminal pH in dairy cattle with SARA is apparently due to the total accumulation of volatile fatty acids alone and is not due to lactic acid accumulation (Krause and Oetzel, 2006). Though SARA may be a common and economically important problem in dairy herds (Garrett *et al*., 1997), its clinical signs can be subtle and easily overlooked. These include decreased dry matter intake, laminitis, rumenitis, liver abscesses, pulmonary bacterial emboli, loss of body condition, diarrhoea and milk fat depression (Garrett *et al*., 1999; Kleen *et al*., 2003). SARA is estimated to cost the U.S. dairy industry between US$ 500 million to US$ 1 billion a year (Krause and Oetzel, 2006). In a case study of 500 dairy cows, decrease in milk production of 3 kg/cow/day and decreased milk fat and true protein were calculated from 37 to 34 g/kg and 29 to 28 g/kg, respectively (Stone, 1999). The recommended protocol for SARA diagnosis is collection of ruminal fluid by rumenocentesis from a sub-sample of 12 cows from a herd or diet group. If three or more cows in either group have rumen pH of 5.5 or less, the group is considered to be experiencing SARA (Nordlund *et al*., 1995; Garrett *et al*., 1999).

Little information is available on the prevalence of SARA (Kleen *et al*., 2003). This study was designed to estimate the prevalence of subacute ruminal acidosis in some dairy herds of Khorasan Razavi province, northeast of Iran.

Materials and Methods

From September 2006 to November 2006, 10 Holstein dairy herds in Khorasan Razavi were selected according to willing for participation in the study. All herds were greater than 250 cows in size and were fed total mixed rations (TMR).

Two groups of 12 cows, were selected randomly in each herd. One group consisted of early lactation cows (3-20 days in milk) while the other consisted of mid-lactation cows (60-150 days in milk). In one dairy herd (dairy herd B), according to different housing and feeding routines, two groups of 12 early lactation cows were sampled (first lactation cows and cows with more than one lactation periods). Additionally, in four herds, no early lactation samples were obtained because there were not enough early lactation cows.

Four to six h following morning TMR feeding and after clinical examination, ruminal fluid collection was carried out by means of rumenocentesis (Nordlund *et al*., 1995) from 205 selected cows. Ruminal fluid pH was determined immediately with a portable pH-meter (Horiba, B-213, Kyoto, Japan). All animals were scored for number and quality of rumen contractions, faecal quality (consistency, presence of undigested feed particles and gas bubbles) and body condition (Table 1).

Additionally urine pH was determined (mid stream samples) for 32 cows and milk samples were collected from morning composite milk of 34 cows. Milk samples were analyzed for fat and protein contents.

Statistical analysis was preformed using SPSS12 (Illinois, Chicago). Body temperature and quality of rumen contractions were analyzed for correlation with ruminal pH by Spearman's rank correlation. Correlations of urine pH and number of rumen contractions with ruminal pH were analyzed by Pearson's correlation tests. Two sample t-test was used to detect differences in parameters between early lactation and mid-lactation groups. The same test was applied for comparison between animals having SARA (rumen pH$\leq$5.5) and the rest of the cows. Chi-square tests were used for statistical analysis of data with ordinal character (scores for body condition, faecal quality and quality of rumen contractions). Analysis of variance (ANOVA) and chi-square tests were used for comparison between animals with SARA, animals with a marginal pH, and the rest of the cows. Differences were considered significant at p<0.05.

Results

It was possible to draw a ruminal fluid

Table 1: Overview of scoring rumen contractions, faecal quality and body condition scores used for examination of selected cows

Parameter	Scores				
	1	2	3	4	5
Quality of rumen contractions (1-3) (Kleen, 2004)	Indistinct ruminal movement	Hearable with stethoscope	Clearly distinctive with instruments		
Faecal consistency (FCS: 1-5) (Hughes, 2001)	Very dry, lumpy	Dry, stiff, semi formed pats	Circular, moist raised pat with petal like symmetrical rings surrounding a dipped centre	Flat, loose, thinly spread	Liquid pools of faeces
Faecal undigested feed particles (FFP: 1-4) (Kleen, 2004)	No undigested feed particles	Presence of few undigested feed particles	Undigested feed particles clearly visible	Massive presence of undigested feed particles	
Faecal gas bubbles (FBS: 1-3) (Kleen, 2004)	No gas bubbles	Presence of few gas bubbles	Massive presence of gas bubbles		
Body condition score (BCS:1-5) (Rodenburg, 2004)	Sunken anus, Visible vertebral spinous process, Sharp hook and pin bones, Incurving thurl region	Less sunken anal region, Less visible vertebra, Less severe thurl region depression	Round background, hook and pin bones, Filled anal area but without fat deposit	Fat patches deposit around pin bone, Smoothed hook bone, Flat span between hook bones, Flattening of backbone ridges	Invisible backbone, hook and pin bone, Fat deposits around the tail bone

from 196 out of 205 initially selected animals (75 early lactation and 121 mid-lactation cows). Overall, 54 cows (27.6%) had a ruminal pH≤5.5 at the time of rumenocentesis, 22 (29.3%) early lactation and 32 (26.4%) mid-lactation cows. The minimum and maximum pH values were found to be 5 and 6.5, respectively. Marginal pH values, between 5.6 and 5.8, were found in 38 cows (19.4%) out of all cows, 9 (12%) early lactation and 29 (23.9%) mid-lactation cows.

At the time of rumenocentesis, early lactation cows in 4 farms and mid-lactation cows in 7 farms were found to be experiencing SARA (at least 3 cows out of 12 had a ruminal pH≤5.5). Early lactation cows in 1 farm and mid-lactation cows in 2 farms were marginally acidotic (Table 2). If one-third or more of cows had a rumen pH values between 5.6 and 5.8, the animals were considered to be marginally acidotic.

To evaluate any influence of SARA on faeces consistency, faecal consistency score (FCS) 3 was considered as normal FCS, while FCS 4 and FCS 5 were considered as abnormal. Also, faecal gas bubbles score (FBS) 1 and faecal undigested feed particles score (FFP) 1 and 2 were considered as normal while FBS 2 and 3 and FFP 3 and 4 were considered as abnormal.

There were no significant differences between cows experiencing SARA and the rest of cows in body temperature (P = 0.861), urine pH (P = 1), milk fat percentage (P = 0.772), milk protein percentage (P = 0.521), age (in month, P = 0.383), number of rumen contractions (in 2 min, P = 0.592), BCS (P = 0.879), FCS (P = 0.908), FBS (P = 0.577), FFP (P = 0.288) and quality of ruminal contractions (P = 0.308).

No significant difference was detected between animals with SARA and those with marginal pH values and the rest of the cows for body temperature (P = 0.558), urine pH (P = 0.564), milk fat percentage (P = 0.594), milk protein percentage (P = 0.757), age (in month, P = 0.664), number of rumen contractions (in 2 min, P = 0.455), BCS (P = 0.167), FCS (P = 0.985), FBS (P = 0.375), FFP (P = 0.456) and quality of ruminal contractions (P = 0.57).

Table 2: Overview of obtained results from 10 selected dairies

Farm-Herd size	Group of cows	Number of sampled cows	Number of SARA-affected cows	Group interpretation
A-399	Early lactation	12	1	Not affected
	Mid-lactation	13	4	SARA-affected
B-1688	Early lactation-Primiparous	12	3	SARA-affected
	Early lactation-Multiparous	12	4	SARA-affected
	Mid-lactation	12	4	SARA-affected
C-918	Mid-lactation	12	2	Marginally acidotic
D-250	Mid-lactation	10	5	SARA-affected
E-438	Mid-lactation	12	4	SARA-affected
F-832	Early lactation	11	1	Marginally acidotic
	Mid-lactation	12	1	Marginally acidotic
G-1440	Early lactation	9	5	SARA-affected
	Mid-lactation	12	3	SARA-affected
H-1376	Early lactation	9	3	SARA-affected
	Mid-lactation	13	4	SARA-affected
I-1395	Early lactation	11	5	SARA-affected
	Mid-lactation	12	5	SARA-affected
J-525	Mid-lactation	12	0	Not affected
Total	--------	196	54	--------

No significant differences were found between early lactation and mid-lactation cows in ruminal pH (P = 0.366), FCS (P = 0.97), FBS (P = 0.91), FFP (P = 0.11), proportion of animals with ruminal pH≤5.5 (P = 0.66), urine pH (P = 0.123) and proportion of animals with SARA and a marginal pH and the rest of the cows (P = 0.65).

There were no significant correlations between ruminal pH and body temperature (r_s = -0.008, P = 0.9), and between ruminal pH and quality of rumen contractions (r_s = -0.072, P = 0.3). No significant correlation was found between ruminal pH and the number of ruminal contractions (r = -0.36, P = 0.616).

Discussion

The prevalence rate of the disease in our study was higher than that reported by other authors. Screening of 15 Holstein herds in the US revealed the presence of SARA in 19% of the early lactation cows (2-30 DIM) and in 26% of the mid-lactation cows (90-120 DIM). More than 40% of the lactating cows tested had ruminal pH≤5.5 in five of 15 herds (Garrett *et al*., 1997). Oetzel *et al*. (1999) found an incidence of SARA of 20.1% in cows between 1 and 120 DIM on dairy farms in Wisconsin. Eleven percent of early lactation cows (up to 25 DIM) and 18% of cows longer in lactation (25-182 DIM) were found experiencing SARA in a survey by Kleen (2004) on 10 farms in Denmark. The overall prevalence of the disease in 197 animals in their study was 14%. Grain type (use of barley rather than corn as the main grain), fine grinding of barley and poor feeding management were diagnosed to be underlying factors responsible for higher SARA prevalence in our studied dairy herds. Both ration formulation and poor feeding management were key factors responsible for SARA in studied dairy herds (Nordlund *et al*., 1995).

Significant signs of SARA were not identified in the present study, although a depression of milk fat and protein percentage in SARA-affected cows has been documented by Kleen *et al*. 2003. However, some authors believe that SARA does not cause milk fat depression, and short-term SARA challenges have no effect on milk contents (Kleen, 2004; Oetzel, 2005). Changes in faecal consistency and structure of SARA-affected cows have been described (Kleen *et al*., 2003). Our results, however, did not confirm significant differences between SARA-affected and non-affected cows in faecal consistency and structure. Considering the fact that SARA has to be understood as an episodic condition with no clinical consequences visible at the time of insult, it seems that faecal changes apply to more severe states of ruminal acidosis rather than to SARA.

According to our results, urine pH had no diagnostic value in detection of SARA-affected cows. The use of urine pH in diagnosis of SARA has been doubted (Kleen, 2004), although, it is recommended by Enemark *et al*. (2002), as the most efficient diagnostic parameter.

Decreased number of rumen contractions as a clinical sign of SARA has been documented (Underwood, 1992; Enemark *et al*., 2002). Our experiment, however, did not confirm significant differences between SARA-affected and non-affected cows in number and quality of ruminal contractions.

According to our results, though SARA was a common problem in studied dairy herds, affected cows did not show typical clinical signs.

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