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Short Communication

Effects of bovine necrotic vulvovaginitis on productivity in a dairy herd in Israel

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Abstract

Bovine necrotic vulvovaginitis (BNVV) is characterized by the development of a necrotic vulvovaginal lesion, almost exclusively in post-parturient first-lactation cows, associated with *Porphyromonas levii*. The scope of this survey was to evaluate the impact of BNVV on herd productivity as a means to rationally evaluate the resources that should be allocated in dealing with the syndrome. During an outbreak of BNVV in a dairy herd, following the introduction of a large number of cows from another farm, the impact of the animals' origin (local or transferred) and BNVV (positive or negative) upon involuntary culling rate, milk yield and days between pregnancies were assessed. The results indicated that the number of days between pregnancies was significantly higher in first-lactation cows with BNVV but was not influenced by the other independent variables. None of the other variables included in this survey had any effect on the involuntary culling rate and milk yield.

Keywords: Necrotic vulvovaginitis; Milk production; Fertility; Involuntary culling

During the initial description of an outbreak of bovine necrotic vulvovaginitis (BNVV) in 2002, morbidity and mortality rates were 82% (32/39 post-calving heifers) and 15.62% (5/32 post-calving heifers), respectively (Elad et al., 2004). In the following years, additional outbreaks were diagnosed in about a dozen dairy herds in Israel, with variable prevalence and incidence. The syndrome is characterized by the development of a necrotic vulvovaginal lesion, almost exclusively in post-parturient first-lactation cows, during the first week after calving. While the anaerobic, Gram-negative bacterium *Porphyromonas levii* was closely associated with the lesions, the risk factors associated with the development of the syndrome are still under investigation. A characteristic common to all the affected herds was the introduction of large numbers of cattle, usually due to the merger of two or more dairy farms.

A preliminary survey (Yeruham et al., 2007) indicated that BNVV may have long term economic implications resulting from reduced productivity. This is in addition to the need to cull some of the affected first-lactation cows that developed complications such as metritis and peritonitis. To further clarify this topic as a means to rationally evaluate the resources that should be allocated in dealing with the syndrome, we conducted a comprehensive survey of a dairy herd (not included in the survey of Yeruham et al., 2007) during an outbreak of BNVV. In this report, we will focus on the impact of the syndrome on productivity. The clinical and microbiological aspects will be published separately.

The herd consisted of 450 lactating cows and 500 heifers of the Israeli-Holstein breed. About half of these animals were from another dairy farm and mixed with the local

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animals. The animals were kept under a zero-grazing, loose housing management system, in completely covered open sheds which were ventilated by means of electric fans. About 5 months after the merger of the two dairy farms, the first cases of BNVV were observed in post-parturient first-lactation cows.

The clinical and bacteriological follow-up lasted 4 months. First-lactation cows were examined for the first time within 7 days of calving and thereafter weekly until clinical remission and becoming negative to culture for *P. levii* (whichever occurred last). Bacteriological examinations were conducted as previously described (Elad et al., 2004). Briefly, aerobic cultures were performed on nutrient agar, 5% sheep blood agar and MacConkey agar plates. Identification of aerobic isolates was made by classical methods (Quinn et al., 1994). For anaerobic cultures, 5% sheep blood agar plates were incubated for 5 days in anaerobic conditions (AnaeroPack System, Mitsubishi Gas Chemical Company). Pigmented colonies were isolated and identified by selected biochemical reactions (indole, alpha-fucosidase, alpha- galactosidase, beta-galactosidase, *N*-acetyl-beta-glucosaminidase and catalase) (Jousimies-Somer et al., 2003) of the ID 32A kit (BioMerieux). First-lactation cows were defined as clinically BNVV positive based on the appearance of necrotic vulvovaginal lesions.

Data on milk yield (kilograms adjusted for 305 days lactation) and days between pregnancies were gathered from the herd's computerized database 6 months after completing the clinical and microbiological follow-up. Statistical analysis was performed by the Statistix package, version 7 (Analytical Software). The following groups were compared: (1) milk yield by animals' origin (local or transferred); (2) milk yield by BNVV (positive or negative); (3) days between pregnancies (DBP) by animals' origin (local or transferred); (4) DBP by BNVV (positive or negative).

One way ANOVA and the Kruskal–Wallis tests were performed to analyze data pertaining to milk yield (normally distributed) and DBP (not normally distributed), respectively. Involuntary culling rate (ICR) of BNVV positive and negative post-calving first-lactation cows were compared by the chi-square test.

Out of 102 first-lactation cows that calved during the 4 months of the study period (May–August, 2005) and were included in the survey, 29 developed BNVV (period prevalence = 28.43%). Monthly incidence rates (BNVV cases/post-parturient heifers) were 41.7% (15/36), 27.3% (6/22), 13.8% (4/29) and 26.7% (4/15), respectively. Pigmented Gram-negative anaerobic bacteria were isolated from all the animals with necrotic lesions. The isolates were indole, alpha-fucosidase and alpha- galactosidase negative, and beta-galactosidase, *N*-acetyl-beta-glucosaminidase and catalase positive. Consequently, they were identified as the animal variant of *P. levii*. Sixteen out of 73 BNVV negative animals (21.92%) were removed from the herd during the survey period due to infertility or low milk yield. The corresponding number for BNVV positive animals was 6/29 first-lactation cows (20.69%).

Descriptive statistics for milk yield, DBP and ICR are presented in Table 1. No differences between local and transferred animals in milk yield or DBP were observed (data not shown). DBP values were significantly ($P = 0.043$, 95% confidence interval) greater in BNVV positive first-lactation cows then in unaffected animals. ICR of BNVV positive first-lactation cows did not differ significantly from those of BNVV negative animals.

The fact that BNVV may cause direct economic losses due to increased ICR of afflicted cows and indirect losses resulting from decrease in milk yield and infertility has been indicated previously by Elad et al. (2004) and Yeruham et al. (2007). In the current study, conducted on a farm not included in the previous study, an attempt was made to study the economic aspect of the syndrome by expanding the number of observed animals and by statistically analyzing the results. Unlike the outbreak described by Elad et al. (2004), no increase in ICR in BNVV afflicted

Table 1
Descriptive statistics for milk yield (kilograms), days between pregnancies and involuntary culling rates observed in an Israeli dairy farm during a survey conducted during 2005 aimed at evaluating the impact of BNVV on herd productivity as a means to rationally assess the resources that should be allocated in dealing with the syndrome

		BNVV negative ($n = 57$)	BNVV positive ($n = 23$)
Milk yield	Mean	11312	11751
	SEM	198.0	299.5
	Median	11470	11958
Days between pregnancies	Mean	126.15	152.75
	SEM	6.9	14.0
	Median	111	128.5
	1st Quartile	100	106.25
	3rd Quartile	132.50	188.25
Involuntary culling rates			
		BNVV negative ($n = 16$)	BNVV positive ($n = 6$)
Local ($n = 12$)		9	3
Transferred ($n = 10$)		7	3

BNVV: Bovine necrotic vulvovaginitis. SEM: standard error of means.

first-lactation cows was observed during the present survey. This may be a result of differences in the severity of the outbreaks. In the previous study, the morbidity rate in post-calving first-lactation cows was 82%, whereas during the current survey the morbidity rate was only 28.43%. Moreover, the direct ICR (complications of the infection) in the previous study was 15.62%, whereas in this survey only one animal out of the 29 that developed BNVV (3.45%) was removed as a direct consequence of the infection.

Although a temporary decrease in milk yield in BNVV afflicted cows was reported by Yeruham et al. (2007), their results were only preliminary and were without a statistical analysis of those findings. Consequently, the fact that no differences in milk yield were found in the current survey may be the consequence of a more detailed breakdown of the results and their statistical analysis. One of the limitations of case studies is the difficulty in extrapolating the results to larger populations. Unfortunately, the number of herds afflicted by outbreaks of BNVV is too limited to conduct a herd level survey. It is of interest, however, that our results are generally in agreement with those previously published on the topic of economic damages caused by BNVV (Yeruham et al., 2007). However, further case studies conducted in different herds may lead in the future to more definite results.

Finally, the most important result of this survey is the significant increase in DBP values in first-lactation cows following episodes of BNVV. Although the economic significance of this observation may vary, we believe that it warrants further studies of the syndrome, eventually leading to its prevention.

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