Effects of subclinical bovine leukemia virus infection on some production parameters in a dairy farm in southern Turkey

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ABSTRACT

Some production parameters of seropositive cows (age, first calving age, 305 day mature equivalent last milk yield production, lifetime mature equivalent milk yield production, lifetime total milk production, lifetime total milking period, lifetime monthly milk production, lifetime daily milk production, lifetime total days of milking, number of inseminations per pregnancy (for last pregnancy), number of calves and calving interval (for last pregnancy)) were analysed in the current study. The study population was clinically healthy Holstein cows from a commercial dairy herd in southern Turkey. Of 109 animals, 65 cows were seropositive by ELISA and the prevalence of bovine leukemia virus (BLV) infection was 59.6 %. The prevalence of seropositive cows in 2nd (62.8 %), 3rd (64.7 %), 4th (61.5 %), and 5th (66.6 %) lactations was slightly higher than that of cows in 1st (52.6 %) lactations. No statistical differences were observed between BLV seronegative and seropositive cows for production and reproduction parameters analysed in this study ($P > 0.05$).

Key words: bovine leukemia virus, dairy cows, production.

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INTRODUCTION

Bovine leukemia virus (BLV) belongs to the genus *Deltaretrovirus* (DDD retroviridae) in the subfamily Orthoretrovirinae[18]. The virus has been detected in lymphocytes in colostrum and milk samples contaminated with blood[15]. In the United States (USA) and Israel, the frequency of BLV infection was higher in dairy cows than beef cattle[1].

BLV infection may result in economic losses due to decreased milk production, decreased reproductive efficiency (such as number of calves and calving interval), subclinical mastitis, increased morbidity, reduced weight loss and death[23]. An examination of the economic impact of BLV indicated that reduced milk production attributed to the presence of BLV in dairy cows, reduced the consumer surplus by 2.7 ± 2.3 billion US$, and resulted in a total loss of 720 ± 560 million US$ to the US economy in 1996[16].

During the first phase of BLV infection, changes such as lymphocytosis, abnormalities in immunoglobulin production, decreased cytotoxic response in infected target cells, and clinical signs have not been reported[27]. There are only limited studies on production variables of aleukaemic cattle. No differences have been reported on milk production and reproductive life-span of seropositive and seronegative herds[14]. Conversely, the clinical form of BLV (lymphosarcoma) has been reported to cause a decrease in milk yield and reproductive performance in dairy cows[19]. Brenner *et al.*[2] also reported that BLV seropositive cows had a shorter life-span and survival rate, a reduced amount of milk yield (3.5 %), and longer dry periods (48 days).

The aim of the present study was to compare some production and reproduction parameters of seronegative and seropositive dairy cows and to establish whether BLV infection has a negative effect on these parameters.

MATERIALS AND METHODS

Farm and animals

The study group comprised 109 Holstein-Friesian cows kept on a dairy farm in Southern Turkey. All animals were housed in free-stall barns with close contact between animals. During the study period none of the cows exhibited any overt clinical signs of BLV and other diseases. None of the animals had ever been vaccinated against BLV. To exclude the possible effects of nutritional deficiencies on production and reproduction parameters, cows with body condition scores lower than 2.5 were not included in the study[9,17]. Rations were recalculated and adjusted every 15 days according to milk production figures. The mature-equivalent (ME) values were obtained from the farm records. Lactations were stratified 1, 2, 3, 4 and 5. Information from complete lactations was used to analyse the production variables.

Serology

Serum samples were taken from all cows in a purebred Holstein herd for 4 consecutive years (2002–2005). Blood samples from cows were collected from the jugular vein into tubes containing no anticoagulant and centrifuged at 2000 rpm for 20 min. Sera were stored at –70 °C until use. BLV antibodies were determined using a commercially available ELISA kit (BLV-ELISA Antibody Test Kit, VMRD Inc., USA) as described by the manufacturer.

Statistical analysis

The differences in production parameters for BLV seronegative and BLV seropositive cows were compared by the Proc Mixed procedure of SAS.

RESULTS

The prevalence of BLV infection in the current study is shown in Table 1. The percentage of seropositive cows was slightly lower during the first lactation, and the prevalence of BLV infection was 52.6, 62.8, 64.7, 61.5 and 66.6 % for cows in their 1st 2nd 3rd 4th and 5th lactations, respectively. Production responses of 12 parameters are presented in Table 2. The age (69.18 *vs* 73.34 months), first calving age (40.15 *vs* 39.01 months), 305-day mature equivalent last milk yield production (5034.5 *vs* 5231.2 kg), lifetime mature equivalent milk yield production (5262.8 *vs* 5327.1 kg), lifetime total milk production (6153.1 *vs* 6223.8 kg), lifetime total

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Table 1: **Prevalence of BLV antibodies in cows with varying completed lactation.**

Completed lactations	Total cows in a group	Total seropositive cows in a group	% Seropositive cows in a groups	% Cows in lactation groups
1	38	20	52.6	34.9
2	35	22	62.8	32.1
3	17	11	64.7	15.6
4	13	8	61.5	11.9
5	6	4	66.6	5.5
Total	109	65	59.6	100.0

milking period (31.31 *vs* 35.14 months), lifetime monthly milk production (478.13 *vs* 498.05 kg), lifetime daily milk production (15.88 *vs* 16.53 kg) and lifetime total days of milking (940.59 *vs* 1055.8 days) did not differ between BLV seronegative and seropositive cows. No difference was observed in reproductive performance measured in the current study. The number of inseminations per pregnancy (for last pregnancy) (1.50 *vs* 1.52), total number of calves born (2.93 *vs* 3.27), and calving interval (for the last pregnancy) (400.34 *vs* 428.46 days) for BLV seronegative and seropositive cows were not significant (Table 2).

DISCUSSION

Ferdinand *et al.*[8] calculated the prevalence of BLV on different lactations in 765 Holstein cows. They reported that the prevalence of BLV was 43, 72, 58, 66, and 65 % respectively for cows in their 1st, 2nd, 3rd, 4th and 5th–8th lactation, and the overall average prevalence was about 60 %. Other researchers[14] stated that the prevalence increases with an increased number of lactations. The prevalence of BLV is influenced by age and seropositivity increases in older cows. The greatest rise takes place during the period between the first and second lactations. Introduction of first calf heifers into heavily infected milking herds leads to an increase in prevalence when they reach their second lactation. Moreover, BLV infected cows at the end of their 1st lactation or dry period are more susceptible to some factors and thus, virus expression increases greatly[14]. Similarly, in the current study the prevalence increased sharply to 62.8 % among animals in their second lactation. The reason for a higher prevalence in older animals could be due to different causes. When animals are housed in the same free-stall barns, close contact amongst animals could increase viral transmission. As a cow progresses to an older age, the probability of sufficient contact with an infected animal and transmission of infection from infected herdmates increases. In addition, older animals are more susceptible to infections[4].

The effects of subclinical BLV infection on milk production and other production performance parameters have been investigated[11,14]. Previous studies have shown that BLV-infected cattle may result in direct economic losses for reasons other than tumor development[11,12]. In the United States, for the dairy industry as a whole, BLV seropositivity was associated with a loss to producers of $285 million and for consumers $240 million. Most of this $525 million industry loss was due to reduced milk production in test-positive herds[20].

In a study with 400 cows, Pollari *et al.*[21] investigated the effect of BLV infection on production parameters. The seropositive groups of cows had better milk production, 305-day ME yields, and days milked per lactation on average than seronegative cows. Similarly, Wu *et al.*[26] compared the milk production of 133 subclinical BLV seropositive cows with 56 BLV seronegative cows. Actual and adjusted 305 days-ME milk production was significantly greater in BLV-infected cows then seronegative herdmates. Çarlı *et al.*[4] reported that, 305-day ME yield, lifetime total milking period and lifetime total days of milking were greater for BLV seropositive cows. On the other hand, others[6,7,20] found a reverse relation between herd-level milk production and BLV status. They concluded that this relationship might be a direct one, or might be related to unmeasured management variables associated with both milk production and BLV status.

Jacobs *et al.*[13] analysed 2079 cows from 61 herds and could not find significant differences in milk production between BLV seropositive and seronegative cows. Similarly, Huber *et al.*[11] reported that BLV did not affect the actual and ME yield. In the current study, 305 day mature equivalent last milk yield production, lifetime mature equivalent milk yield production, lifetime total milk production, lifetime total milking period, lifetime monthly milk production, lifetime daily milk production and lifetime total days of milking did not differ between BLV seronegative and seropositive cows. Further studies were made by others on 998 cows from 268 dairy herds and they reached to the same conclusion, namely, no significant association was detected between BLV seropositivity and milk production[10,25].

Table 2: **Comparison of the production and reproduction parameters between BLV seronegative and seropositive cows** ($\bar{x}$ ± SE)**.**

Parameters	BLV seronegative (n = 44)	BLV seropositive (n = 65)	*P*
Age (month)	69.18 ± 3.99	73.84 ± 2.89	0.3469
First calving age (month)	40.15 ± 3.04	39.01 ± 2.00	0.7548
305 day mature equivalent last milk yield production (kg)	5034.5 ± 211.77	5231.2 ± 192.46	0.4935
Lifetime mature equivalent milk yield production (kg)	5262.8 ± 194.22	5327.1 ± 162.50	0.8000
Lifetime total milk production (kg)	6153.7 ± 349.79	6223.8 ± 243.45	0.8699
Lifetime total milking period (month)	31.31 ± 1.78	35.14 ± 1.74	0.1279
Lifetime monthly milk production (kg)	478.13 ± 16.96	498.05 ± 16.54	0.4024
Lifetime daily milk production (ℓ)	15.88 ± 0.56	16.53 ± 0.55	0.4118
Lifetime total days of milking	940.59 ± 53.39	1055.8 ± 52.51	0.1272
Number of inseminations per pregnancy (for last pregnancy)	1.50 ± 0.11	1.52 ± 0.09	0.8793
Number of total calves	2.93 ± 0.18	3.27 ± 0.16	0.1637
Calving interval (day) (for last pregnancy)	400.34 ± 15.42	428.46 ± 17.01	0.2494

Inconsistent results between these previous studies are not surprising. Researchers[5] indicated that the essential problem in interpretation or comparing these studies is that seropositive animals are heterogeneous for disease status (asymptomatic, persistent lymphocytosis and tumors). Furthermore, the genetic potential for milk production was not taken into account in these studies.

Our results of age at first calving are in agreement with others reports[21]. Similarly, Jacobs *et al*.[13] stated that age at first calving was 62.9 and 55.7 months for BLV-seropositive and seronegative cows, respectively. Çarlı *et al*.[4] also reported no difference in age at first calving between BLV seronegative (51.6 months) and seropositive (60.9 months) cows. However, another study concluded that BLV increases the age of first calving[26]. In the current study, there was no statistical difference between BLV seropositive cows (73.84 months) and BLV seronegative cows (69.18 months) for age at first calving. Likewise, the number of inseminations per pregnancy (for last pregnancy) did not differ between BLV seropositive cows (1.52 times) and BLV seronegative cows (1.50 times) in the present study. Other reports that examined the number of inseminations per pregnancy (for last pregnancy), failed to find any differences between BLV seropositive and seronegative cows[4,11,21].

In the current study, calving intervals of BLV seronegative and seropositive cows did not differ significantly. Usually, the effect of BLV infection on bovine reproduction seems to be minor[10]. The only effect was on the calving interval, which was found to be significant by some[7,20] but insignificant by other groups[2,6].

Several studies have found no significiant differences between subclinical BLV infected cows and uninfected cows with regards to reproduction and production variables[11,14,26]. On the contrary, it has been reported that reproductive and production potential may be reduced in cows infected with clinical BLV, PL^+-positive and lymphomas[22]. Although infection with BLV of the udder reduces productivity[3], it is more logical that deterioration of the well-being of the BLV infected cow results from the detrimental effect on the immune system of the animal, and more so in PL^+ cows. This immune impairment causes increased susceptibility to infectious diseases mostly in subclinical terms, which leads to decreased milk production and slight decreased reproductivity[24].

In conclusion, no statistical differences were observed between BLV seronegative and seropositive cows regarding production or reproduction parameters analysed in this study. The subclinical BLV infection in this Holstein herd did not adversely influence milk production and other production parameters. Thus, BLV-infected cows without clinical signs of disease do not appear to be an economic burden in the herd.

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