Breeding beef bulls as a source of BLV transmission

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Introduction

Bovine leukosis is a chronic lymphoproliferative disorder caused by bovine leukemia virus (BLV) that leads to economic losses in the beef and dairy industries. The USDA NAHMS Beef 1997 study estimated that 38% of cow-calf beef herds and 10.3% of individual adult cows in the US are BLV seropositive. Most BLV infected animals are asymptomatic carriers of the virus while a proportion of infected cattle develop lymphocytosis (30-40%) and lymphosarcoma (5-10%). The major route of virus transmission is iatrogenic through the transfer of blood from infected cattle. BLV proviral DNA has also been identified in nasal secretions, saliva, milk, colostrum, and semen, which could serve as potential sources for virus transmission. In the US, natural service accounts for 90% of the breeding in beef cow-calf operations. During natural breeding, minor genital tract trauma resulting from copulation may lead to blood transfer and transmission of BLV. Alternatively, BLV transmission may occur via transfer of infected secretions including semen and smegma during copulation. Little is known about the prevalence of BLV in breeding bulls and few studies have evaluated semen or smegma as a potential route of BLV transmission. The objectives of this study were to 1) determine the prevalence of BLV in breeding bulls presented for breeding soundness exams (BSE) at Michigan State University (MSU), 2) compare lymphocyte counts in BLV positive and negative bulls, and 3) evaluate the presence of BLV proviral DNA in bull smegma and semen.

Materials and Methods

Whole blood, serum, smegma, and semen samples were collected from 120 adult beef bulls (≥2 years) from 39 beef herds presented for BSE at MSU. Smegma samples were collected using a TRICHITTM Collection device and vigorous back and forth scraping motion along the preputial cavity while applying negative pressure with an attached 10 ml syringe. Semen samples were collected via electroejaculation. DNA was extracted from whole blood, smegma, and semen, and then analyzed for BLV proviral load (PVL) using CoCoMo-qPCR. Serum antibodies to BLV were detected by ELISA (AntelBio, Lansing, MI). Lymphocyte concentrations (LC, cells/μL) were determined by Qscout (Advanced Animal Diagnostics, Morrisville, NC). Prevalence was calculated using ELISA results. LC between BLV-positive and -negative bulls was analyzed by unpaired t-test. One-way ANOVA was performed to compare LC across PVL-based groups (copies /μL): low (1-526); moderate (527<10.000), and high (>10.000). Measures of association between LC and PVL were analyzed by linear regression. All statistical analyses were performed in SAS software (V.9.4).

Results

In our study, the prevalence of BLV was 45% (54/120). Of the farms that presented bulls for BSE, 48% (19/39) had at least one BLV positive bull. LC (mean ± SD) were significantly higher in BLV-seropositive bulls compared with seronegative bulls (6378 ± 2295 vs 5389 ± 1643 cells/μL; P=0.02). The group of bulls with high PVL had higher LC compared with the groups with low or moderate PVL (P=0.0001). There was no significant correlation between LC and PVL (P=0.094). 7.4% (4/54) of BLV seropositive bulls had BLV proviral DNA detected in smegma that ranged between 4.50 - 618.78 copies/μL.

Significance

In this study, a high percentage of adult bulls were found to be BLV positive and could serve as a source of virus transmission within and between cow-calf herds. Bulls with high lymphocyte counts were found to have a higher PVL and may be at higher risk of transmitting the virus. Importantly, BLV proviral DNA was found in ~7% of the smegma samples collected and may serve as a source of virus transmission through copulation during natural breeding. The risk of BLV transmission from BLV positive bulls during natural breeding is unknown and is the subject of future studies.