

Assessment of Regional Spreading Bovine Tuberculosis in Georgia

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ABSTRACT. The goal of this study was to assess regional distribution of bovine tuberculosis (bTB) in domestic cattle in Georgia and describe the disease risk factors. In 2016-2018, 36 slaughterhouses nationwide 2286 cattle were obtained for examination. Out of these, 552 cases were further investigated by histopathological and microbiological methods. Using this hybrid approach (histopathological and microbiological testing), an estimated bovine TB rate is 0.44% (0.36-0.54%) in slaughtered cattle in Georgia. Out of ten regions, only three had bTB cases. The estimated rates were 0.98% (0.27-2.49%), 1.36% (0.28-3.92%), and 1.84% (0.50-4.65%) for Kvemo Kartli, Shida Kartli and Javakheti regions, respectively. The study revealed that the disease antecedents in the region, cattle female gender and older age (>2years old) are bTB risk-factors in Georgia. Stratified analysis shows that the stratum with the highest composite risk (>2 years old female cattle slaughtered in the region with bTB antecedents) has estimated bTB prevalence - 1.61%. © 2019 Bull. Georg. Natl. Acad. Sci.

Key words: cattle, zoonosis, bovine tuberculosis, Georgia

Bovine Tuberculosis (bTB) in Georgia has been officially registered since the middle of the twentieth century. At that time the disease was discovered only in two regions of the country – Kvemo Kartli and Javakheti. Although, in 1953-1965 there were revealed 73 locations (soviet style collective farms) in the country with bTB cases, in 1972, only 5 districts had bTB, and all of them were restricted to 15 collective farms. In 1984, an epizootic study revealed bTB cases in 19 districts. After collapse of the

country's Sanitarian-Epidemiological system only few studies addressed bTB problem in Georgia. In 2001–2003, Baratashvili et al examined LN extracted from raw beef products in Georgian supermarkets. The group found 20 strains of mycobacterium bovis present in the collected samples [1].

Technical Approach and Methodology

Necropsy. Procedures in the slaughterhouse included palpation and incision of lymph nodes.

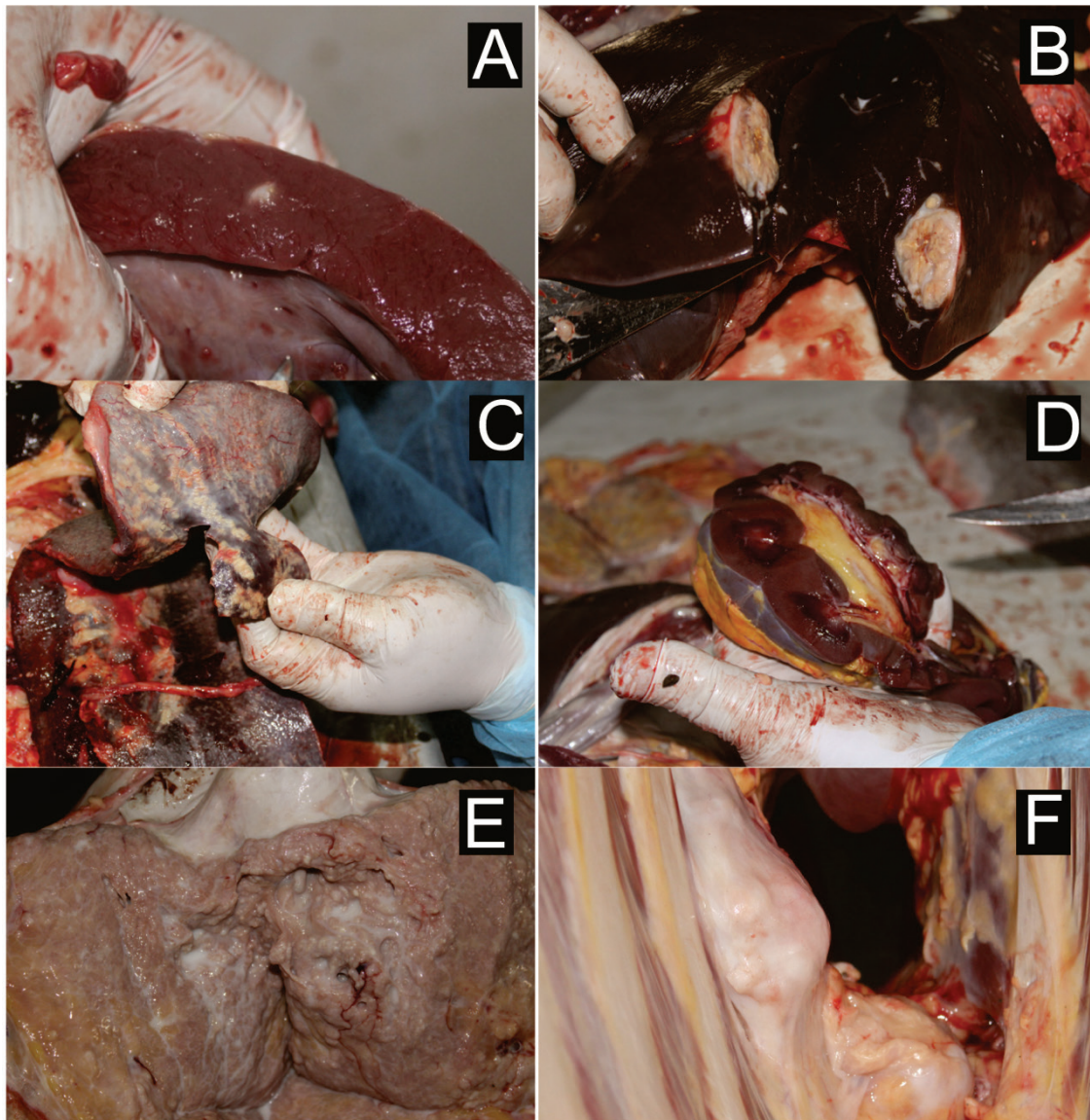


Fig. 1. Tuberculosis changes in different organs of the cattle: A-heart, B-liver, C-spleen, D-kidney, E-udder, F-bone.

Once suspected gross tuberculosis-like lesions (TBLL) were identified in the tissues, the selected samples either were refrigerated (4°C) and dispatched for detection of mycobacterium sp. within the first 48–72 hours, or stored at -20°C until processing.

Diagnostic Testing of Bovine Isolates

Bacteriology. Selected bovine samples from every animal were subjected to bacteriological culture regardless of TBLL presence or not [2, 3].

Pathology assessment. A lung lesion score was calculated by counting the total number of lesions and applying a score as described by Parlane, et al. [4]. Scoring of histopathological lesions in the lymph nodes was based on the scale described by Wangoo, et al. [5].

Data analysis. Disease prevalence was determined as a proportion of positive bTB diagnostic results out of the total cases examined. Model fit to the recorded data was

assessed by C-statistics and Hosmer-Lemeshow goodness-of-fit test.

Results. During the study period 322,074 cattle were slaughtered in ten regions of Georgia. 2286 animal carcasses (0.7% of all slaughtered cattle) were randomly selected from all slaughterhouses that were operational in all ten regions of the country during the study period.

During the study period 11 bTB cases were revealed, all diagnoses were confirmed microbiologically and histopathologically. The macromorphological tuberculosis changes are mainly presented in the chest lymph nodes and lungs 4 cases were the generalized form of tuberculosis where the changes were presented differently including the heart, liver, spleen, kidney, udder as well as bone (Fig. 1).

By applying hybrid histopathologic and microbiological diagnostic, out of the 552 examined cases 11 cases were identified to be bTB positive. Therefore, the estimated prevalence and its 95% confidence interval for bovine TB prevalence in cattle slaughtered in Georgia is 0.44% (0.36-0.54%). The rates vary across the regions: no bovine TB case was detected in seven regions of the country and bTB prevalences are 0.98% (0.27-2.49%), 1.36% (0.28-3.92%), and 1.84% (0.50-4.65%) for Kvemo Kartli, Shida Kartli, and Javakheti, respectively. Although most of the slaughtered cattle (79%) were female animals, the rate varied substantially across the regions. The lowest rate, 43.5%, was recorded in Imereti and highest rate, 91.7%, in Samegrelo. The gender difference among regions was statistically significant ($P < 0.001$).

The age information majority (82%) were adult animals (>2 Years old). Across the regions the rate of young adult animals (2-4 years old) varied from 44% (Racha and Kakheti) to 71% (Samegrelo), and the range rates of adult animals (>4years old) were 9% (Ajara) and 43% (Racha). Age variation across the regions was statistically significant ($P < 0.001$).

As 94% of all cases were local breed, all other breeds were combined into one group – non-local breed. The overall proportion of local breed animals varied between 79% and 100% across the regions.

Bovine TB antecedents in a region is the most important risk factor for the disease ($P = 0.002$). Additionally, cattle female gender ($P < 0.10$) and adult age ($P = 0.17$) are also associated with the disease. As the disease prevalence is very low and the rates for young adult and adult groups are similar, these two were combined in one adult group (>2 years old) for further analysis.

As the low number of the primary outcome did not allow to do a multivariate examination of independent risk factors, stratified risk analysis was performed to identify high risk strata for bTB in the country. Animal gender, age, and bTB history of the region were used in the stratified analysis. The reason behind not using animal breed information is explained in a previous paragraph. The study showed that the stratum with the highest composite risk (>2 years old female cattle slaughtered in the region with bTB antecedents) has estimated bTB prevalence – 1.61%.

Discussion. In this study, we found that all bTB cases were diagnosed in adult animals. This agrees to the existing evidence that older animal age is one of the important risk factors of bTB. Studies that were conducted in both developing and developed countries showed that disease rate is significantly higher in adult animals compared to young ones [6, 7]. There are two possible explanations of this association: 1) older animals have high probability to get in contact with the infectious agent; 2) bovine TB has long latent period [8].

There is contradictory information of animal gender role in bovine TB infection. While a study found that male gender is a significant risk factor of bTB [9], another study showed that female gender was associated with the disease development [10]. Our study showed that all the diseased cases were diagnosed in female cattle. This might be explained

by the fact that, in Georgia, female cattle are kept for longer time because of milk production and reproductive purposes. Therefore, the relationship found in our study might be confounded by animal age.

There is evidence that non-local breed cattle have high bTB risk compared to local ones [11]. Due to a high rate of missing breed information and a very low number of animals categorized as non-local breed, we were not able to examine the relationship between cattle breed and bTB infection. However, this should not significantly affect the study findings as the vast majority of the cattle in Georgia belong to the local breed.

This study found that bTB antecedents in the region is the most important risk factor of the infection. Previous studies also showed that the regions with bTB history have a significantly higher risk of the disease outbreak [12, 13].

Based on Stratified analysis, this study shows that bTB risk in the highest risk stratum (>2 years old female cattle slaughtered in the region with bTB antecedents) is about 4 times higher than nationwide rate of the disease.

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საქართველოში მსხვილფეხა რქოსანი პირუტყვის ტუბერკულოზის გავრცელების რეგიონალური შეფასება

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(წარმოდგენილია აკადემიის წევრის ნ. მითავარიას მიერ)

კვლევის მიზანს წარმოადგენდა ტუბერკულოზით დაავადებული მსხვილფეხარქოსანი პირუტყვის გამოვლენა რეგიონების მიხედვით და მოსახლეობის ჯანმრთელობაზე bTB-ით გამოწვეული დატვირთვების შესწავლა. 2016-2018 წლებში ჩატარდა 2286 პირუტყვის კვლევა ქვეყნის მასშტაბით 36 სასაკლაოზე. აქედან, გარდა დაკვლის შემდგომი მაკრომორფოლოგიური შეფასებისა, მოხდა 552 ცხოველის bTB გამოკვლევა ჰისტოპათოლოგიური და მიკრობიოლოგიური მეთოდებით. ამ ჰიბრიდული მიდგომის გამოყენებით, საქართველოში bTB მაჩვენებელი შეადგენს 0,44% (0,36-0,54%). დაავადება გამოვლინდა სამ რეგიონში, ქვემო ქართლში, შიდა ქართლსა და სამცხე-ჯავახეთში, 0,98% (0,27-2,49%), 1,36% (0,28-3,92%) და 1,84% (0,50-4,65%). კვლევამ აჩვენა, რომ საქართველოში bTB რისკ-ფაქტორებს წარმოადგენს მდედრი სქესი, ასაკი (>2 წელი) და რეგიონების ისტორიულად არაკეთილსაიმედოობა. სტრატეგიციფირებული ანალიზი გვიჩვენებს, რომ მაღალი რისკის მქონე ფენისთვის bTB-ის პრევალენტობა შეადგენს 1,61%-ს.

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