

Prevalence and risk factors for leptospirosis in wild and domestic animals in Israel

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Abstract

Background

Despite the recurrence of *Leptospira* outbreaks in humans and animals in recent years, there is still limited knowledge regarding the extent of the disease among animals, and in many cases, the source of infection remains unknown.

Research objectives

1. To conduct a prevalence survey of *Leptospira* serovars in cattle and sheep farms across Israel.
2. To conduct a prevalence survey of *Leptospira* serovars in wild boars across Israel.
3. To identify the risk factors for infection in livestock and wild animals.
4. To establish an infrastructure for future investigations of outbreaks in farms and wildlife. This infrastructure will enable rapid access to outbreak sites along with the necessary tools for bacterial isolation, thereby significantly increasing the likelihood of successful isolation.

Materials and methods

- Collection of serum samples from cattle and small ruminant farms in various regions of the country (geographic areas will be determined according to the veterinary districts).
- Detection of antibodies against different *Leptospira* serovars using the microagglutination test (MAT) and enzyme-linked immunosorbent assay (ELISA).
- An epidemiological investigation will be conducted on each farm using a structured questionnaire to identify potential risk factors for infection, such as contact with wild animals, feed sources, origin of replacement calves, etc.
- Collection of urine and milk samples from positive farms for bacterial isolation.
- Targeted sampling of wild boars in various regions across the country. During sampling, serum, kidney, and urine specimens will be collected aseptically from carcasses.
- Investigation of *Leptospira* outbreaks during the study period — including epidemiological investigation and sample collection.

Main Results

902 serum samples collected from 53 small ruminant herds across Israel and tested using the MAT method for the eight *Leptospira* serovars routinely screened in animals in Israel — Ballum, Bratislava, Hardjo, Canicola, Grippotyphosa, Pomona, Icterohaemorrhagiae, and Tarassovi — only two samples tested positive at a low titer (1:100; one ram and one sheep from two separate farms in the same locality) for the Pomona serovar.

In addition, 757 serum samples collected from cattle in 2023 and 785 historical samples collected in 2017–2018 were tested using a commercial ELISA kit. The overall prevalence of the

Hardjo serovar in cattle increased significantly from 55/785 (7.01%, 95% CI: 5.42%–9.01%) in 2017–2018 to 121/757 (15.98%, 95% CI: 13.55%–18.77%) in 2023 ($p<0.005$). The overall prevalence of the Pomona serovar in cattle did not change significantly between 2017–2018 (42/785; 5.35%, 95% CI: 3.98%–7.15%) and 2023 (44/757; 5.81%, 95% CI: 4.36%–7.71%) ($p=0.16$). No differences in prevalence were observed between cows and heifers for both serovars; however, prevalence in beef cattle in 2023 was significantly higher than in dairy cows.

Furthermore, during the investigation of a *Leptospira* Pomona outbreak on a farm in Kfar Hess, which included dairy cattle, sheep feedlot, serum and urine samples were collected from cattle of different ages and from sheep groups on the farm. Serological exposure and bacterial DNA detection by PCR in urine samples were found exclusively in the dairy herd, despite the close proximity between the dairy barn and the sheep feedlot, as well as the temporal overlap between clinical cases and the arrival of sheep to the farm. The farm served as an educational petting zoo with frequent visitors, and both domestic and wild animals were reported to have access to the premises; thus, these may have been the sources of infection. Attempts to isolate the bacteria from this outbreak were unsuccessful.

Conclusions and Recommendations for Implementation of the Results

The study findings indicate that the prevalence of *Leptospira* infection among sheep and goats in Israel is negligible; therefore, their involvement in the transmission of the tested serovars — particularly the outbreak-associated Pomona serovar — is likely minimal. This conclusion is further supported by the findings from the investigation of the Pomona outbreak in the dairy farm at Kfar Hess.

The prevalence of both serovars in cattle may have been influenced, at least in part, by prior vaccination; however, the absence of a significant difference in prevalence between heifers and adult cows suggests that vaccination is not the only factor affecting the results. Moreover, the higher prevalence observed in beef cattle compared to dairy cows highlights the importance of management practices and exposure to various factors, such as contact with wild animals, in the epidemiology of the disease in Israel.

Unfortunately, data collection from wild animals was not conducted, and therefore their role in the epidemiology of the disease could not be assessed. Nevertheless, considering the host adaptation of the outbreak-associated Pomona strain, the close proximity between wildlife and cattle farms, and the findings from the Kfar Hess outbreak, it is reasonable to assume that wildlife — particularly wild boars — are involved in the disease dynamics in Israel.

Given the observed prevalence of *Leptospira* in cattle, the occurrence of clinical cases in various regions, and their implications for animal welfare, economic losses, and public health, it is recommended to strengthen biosecurity measures and minimize contact with wildlife as much as possible. Additionally, routine vaccination policies should be implemented in cattle herds and dairy farms, especially in high-risk areas where outbreaks have previously occurred.