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Epidemiological Survey on Animal Rabies in the Province of Batna, North Eastern Algeria

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ABSTRACT

Background: Rabies is classified by Algerian authorities as a major zoonotic disease. It is endemic in Algeria and poses a significant threat to public and animal health due to its ability to evolve, spread and cause severe health and economic consequences. Despite scientific advancements in surveillance, vaccination, diagnosis and control, the disease persists. The present study is aimed to assess the epidemiological situation of rabies and determine its prevalence in the Batna province, in order to contribute to improving methods and means of controlling this disease.

Methods: The study was conducted using on the collection of administrative documents and raw data provided by the provincial veterinary inspectorate of the directorate of agricultural services of the Algerian ministry of agriculture and rural development, collected during the years 2024 and 2025. The raw data collected on animal rabies included the number of cases, their spatial and seasonal distribution, the species and eradication data. This data underwent processing and statistical analysis. The various rates were calculated and presented as graphs and map for better visualization and understanding of epidemiological trends and patterns.

Result: Analysis of data collected on rabies cases shows that 44 hotspots were reported in different rural municipalities linked to agricultural activities, including herbivore farming and the use of unvaccinated dogs to guard herds. The data also show that autumn (6 cases during 2024) and summer (5 cases during 2025) were the two seasons with the highest number of rabies cases recorded in Batna province, suggesting environmental and behavioral factors influencing rabies transmission. Finally, the results of the control campaign explain that in 2025, the eradication of animal rabies increased to 59% compared to 52% in 2024, resulting in a decrease in the prevalence of rabies to 41% compared to 48% in 2024.

Key words: Animal rabies, Batna province, Dog, Epidemiology, Zoonosis.

INTRODUCTION

Rabies is one of the oldest known diseases, having a history of more than 4000 years. A disease affecting the Central Nervous System, rabies is almost invariably fatal once manifested (Bhosale *et al.*, 2022). It affects mammals, particularly carnivores, which are the reservoirs of the disease. This is why it is widespread throughout the world, except in some Pacific and Atlantic islands and in Japan. Developed countries such as Great Britain and France and others, have managed to remain rabies-free thanks to a control program based on parenteral and oral vaccination of domestic animals and foxes, widespread human vaccination following exposure and disease surveillance (WHO, 2024). This disease, caused by a single-stranded RNA neurotropic virus of the family Rhabdoviridae and the genus *Lyssavirus*, is one of the most fatal worldwide (Fooks *et al.*, 2017; Taylor *et al.*, 2021). However, mortality can be prevented by proper vaccination of both humans and animals (Abela-Ridder, 2015).

Rabies is an important zoonotic disease; the transmission of the disease to humans is usually through saliva via the bite of an infected animal (Hampson *et al.*, 2015; Monroe *et al.*, 2016). This disease is endemic in developing countries of Africa and Asia. Globally canine rabies causes approximately 70,000 human deaths (Bedeković *et al.*, 2018) and 8.6 billion USD economic losses annually (Hampson *et al.*, 2015). In Algeria, rabies is considered a major zoonosis and the veterinary authorities consider it a priority in the national committee agenda for the fight against zoonosis since 1984 (Benelmouffok, 2004). To deal with this disease, a legislative panel was put in place to ensure mass vaccination of dog populations and to control disease among free-roaming dogs (Kardjadj, 2016). However, despite these measures, this neglected zoonosis is still spreading, resulting in approximately 15 deaths annually. In addition, approximately 120,000 animal bites are recorded every year, with dogs being the primary culprits

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(Algerian Press Service, 2023). Knowledge on the epidemiological factors for canine rabies is needed to assess danger to public health and development of effective, sustainable disease control measures (Sukumar and Gunaseelan, 2016) to eradicate animal and human rabies. The objectives of this study were to describe the epidemiology of animal rabies in Batna province during the years 2024 and 2025, using data obtained from the Algerian ministry of agriculture and rural development, in order to provide more information on animal rabies and to contribute to the methods and means of controlling this disease.

MATERIALS AND METHODS

The present study was carried out in Laboratory of Environment, Health and Animal Production (ESPA) of Institute of Veterinary Sciences and Agronomic Sciences, University of Batna1, in Algeria. The study period was from January 2024 to December 2025.

Study area

The study area covered the province of Batna, located in northeastern Algeria between 4° and 7° east longitude and 35° and 36° north latitude, at the junction of the Tell Atlas to the north and the Saharan Atlas to the south. With an area of 12,038.76 km^2, the province of Batna currently comprises 21 districts (daïras) and 61 municipalities (Making it the fifth largest city in Algeria). In the north, the high tellian plains form the northern boundary of the province, with altitudes ranging from 800 to 1000 meters and slopes rarely exceeding 3% and in the south west, the high steppe plains are characterized by average altitudes below 500 meters. Mountainous terrain, in the southeast, covers 45% of the province's total area, with altitudes ranging from 700 meters to 2326 meters. The climate of the Batna province is that of a semi-arid region where the average annual temperature is 6°C in January and 27°C in July. During the winter, temperatures drop below zero at night, with frequent frosts. The average annual rainfall is 280.5 mm (Chichoune *et al.*, 2022).

Data collection

The data used in this study involve raw data collected from the provincial veterinary inspectorate of the Directorate of Agricultural Services of the Algerian Ministry of Agriculture and Rural Development, collected during the years 2024 and 2025. The raw data collected concerning animal rabies includes the number of cases, their spatial and seasonal distribution, the species, as well as data on eradication through the control of stray animals by periodic culling.

Statistical analyses

The collected data was subjected to processing and statistical analysis using microsoft office excel version 2013 software.

RESULTS AND DISCUSSION

Spatial distribution of rabies cases in the municipalities of the province of Batna

The spatial distribution of animal rabies cases in the municipalities of Batna province shows that 44 hotspots were reported in various municipalities of the province during the two years studied. The locality specific details of the cases of animal rabies when plotted on a map of Batna, was found to show the 'hotspots' of animal rabies to be congregated more towards northern and southwestern parts of the province with 3 or more cases (Fig 1).

Fig 1 shows that rabies is predominantly reported in the northern and Steppic regions; therefore, the affected municipalities are pastorals and agro-pastorals. This result is not surprising, knowing that 90% rabies cases in the world located in rural areas of Africa and Asia, which is probably linked to their poverty and ignorance, according to the World Health Organization (WHO, 2024). The same observation was also reported in India (Sudarshana *et al.*, 2007; Radhakrishnan *et al.*, 2020; Jadav and Patel, 2025) who reported that the geographical distribution of cases was influenced by economic status.

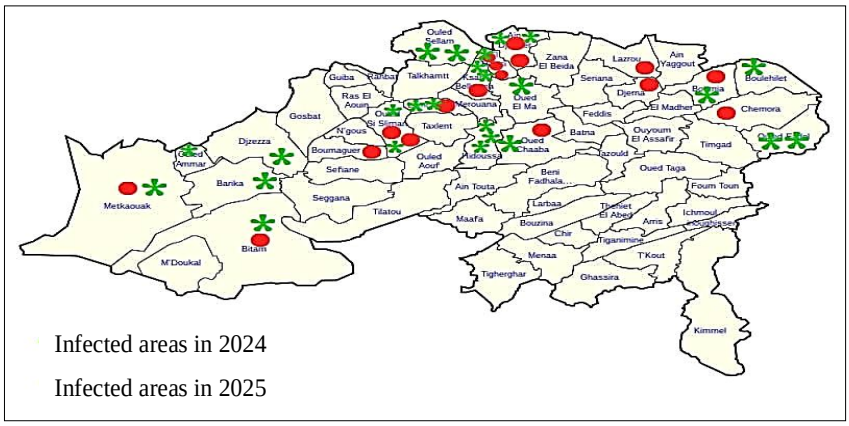


Fig 1: Spatial distribution of rabies cases in the municipalities of the province of Batna.

Temporal distribution of rabies cases in the province of Batna

Fig 2 shows the monthly distribution of rabies cases in the province of Batna during the period of study.

Fig 2 shows rabies cases in animals occurred throughout the past two years, however, two peaks of prevalences were obvious, October (6 cases during 2024) and July (5 cases during 2025). This finding confirms that animal rabies in Algeria has evolved to be endemic throughout the year as reported by Kardjadj (2016) and Lounis *et al.* (2024). Lee *et al.* (2018) reported that, rabies is endemic and has been a notifiable disease for more than 40 years in Vietnam.

Regarding the two prevalence peaks, our results are consistent with those found in Vietnam and India. Lee *et al*. (2018) showed a strong peak in July in the mekong river delta region. However, Sukumar and Gunaseelan (2016) found greater prevalence of rabies cases during October, which was thought to have an association with the breeding season of dogs.

Fig 3 shows the seasonal distribution of rabies cases in the province of Batna during the period of study.

During the study period, the seasonal prevalence of rabies cases was high from April to June and from October to December (30%) for each season in 2024 and high from July to September (47%) in 2025. Our study found that there was a difference among seasons, which could be explained by farming activities and the dog-breeding season as reported by Lee *et al.* (2018). These authors showed that summer and autumn had relatively high incidence, which was associated with farming activities. However, the dog-breeding season (spring and summer) increased the occurrence of rabies due to fight among dogs leading to increased transmission of virus.

Distribution of rabies in animal species in the province of Batna

Fig 4 shows the distribution of rabies in animal species in the province of Batna during the period of study.

The highest number of rabies cases were found in dogs, comprising 48% in 2024 and 35% in 2025, followed

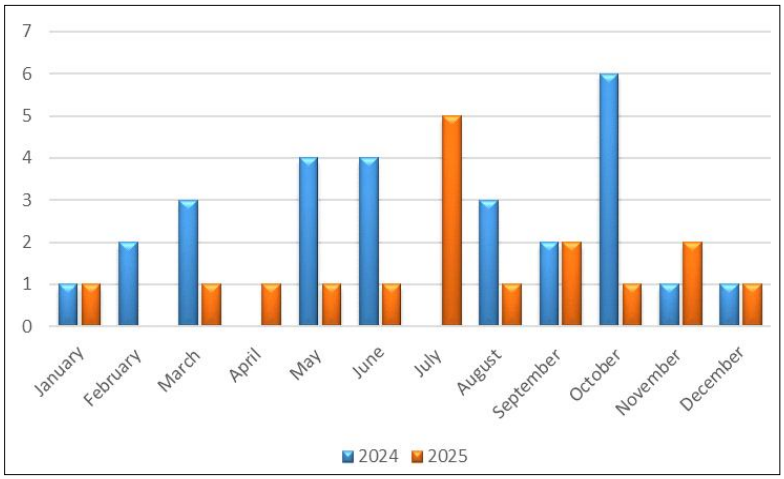


Fig 2: Monthly distribution of rabies cases in the province of Batna.

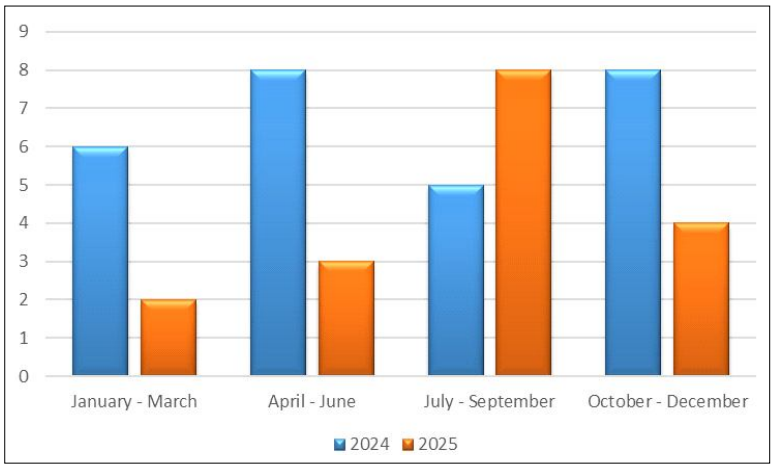


Fig 3: Seasonal distribution of rabies case in the province of Batna.

by cattle comprising 30% in 2024 and 29% in 2025. Our results were similar to those reported by Sachin *et al.* (2021) who found that the majority of rabies cases were dogs followed by large ruminants mostly cattle. Indeed, rabies presents significant risks to the well-being of dogs and is lethal disease (Thakar *et al.*, 2026). These results identified the role of dogs as the main source for animal cases. Indeed, there are a huge number of free-roaming, reproductively active dogs in the world. The number of street dogs is because of uncontrolled breeding and abandonment of both street and pet dogs. Free-roaming dogs may be a source of nuisance, potential risk to livestock and pose serious public health risks (Müller *et al.*, 2023). Therefore, reducing free-roaming dog population size can reduce the risks associated with free-roaming dogs for public health and livestock production (Smith *et al.*, 2022).

The prevalence of rabies cases in ovine species was 15% in 2024 and 12% in 2025. These results were higher than those reported by Sachin *et al.* (2021) who reported 0.57% of rabies cases in sheep.

The high prevalence of rabies cases in livestock in our study could be explained by the use of unvaccinated dogs to guard livestock herds in the affected municipalities. Therefore, livestock is a vulnerable victim of rabid carnivores; it is mandatory to report cases of animal bites, especially dog-to-dog and dog-to-livestock. However, mass dog vaccination is the suggested strategy of choice towards elimination of rabies (Radhakrishnan *et al.*, 2020), as dogs vaccinated against rabies cannot transmit the virus to other dogs, livestock or humans (Müller *et al.*, 2023). Therefore, mass vaccination combined with animal birth control measures to counter population explosion of stray dogs is ideal.

Our results did not reveal rabies cases in goats. This finding was significantly lower compared with previous reports by Sachin *et al.* (2021) and Hossain *et al.* (2022), who reported 4.54% and 1.65% of rabies cases in goats respectively. Although rabies can infect all warm-blooded animals, its occurrence in goats is relatively rare (Johnson *et al.*, 2025). In Algeria, goat farming is indeed a predominant agricultural activity in the mountainous areas that are rabies-free.

Clearly, rabies in cats has seen a significant emergence and was highest in 2025 (18%) and lowest in 2024 with 0%. This prevalence is higher than previous report by Sachin *et al.* (2021) who reported 8.44% of rabies cases in cats. Although cats are carnivores they had a lower rate compared to dogs. Epidemiologically cats are important vectors of lyssaviruses but are not viral reservoirs. Typically, cats are incidental hosts only, infected with the predominant *Lyssavirus* in their geographic locale (Fehlner-Gardiner *et al.*, 2024).

Regarding rabies in horses, our results demonstrate that the prevalence decreases from 7% in 2024 to 6% in 2025. However, these results remain relatively higher than those reported by Sachin *et al.* (2021) who reported only 0.46%.

Rabies control program

Fig 5 shows the rabies control program during the period of study.

Our results show that in 2025, the eradication of animal rabies increased to 59% compared to 52% in 2024, resulting in a decrease in the prevalence of rabies to 41% compared to 48% in 2024. These results demonstrate the significant progress made by the national strategy adopted by Algeria and reinforces the country's commitment to the global "Zero by 30" goal: ending human rabies transmitted by dogs by 2030 (WOAH, 2025).

Despite the continued efforts of Algeria, through equipping the country with modern tools, harmonised indicators and a consolidated vision, in combating this zoonotic disease that is preventable but still deadly.

These results remain insufficient and far from the goal of "Zero human deaths due to dog-mediated rabies by 2030". A new strategy was therefore necessary to combat

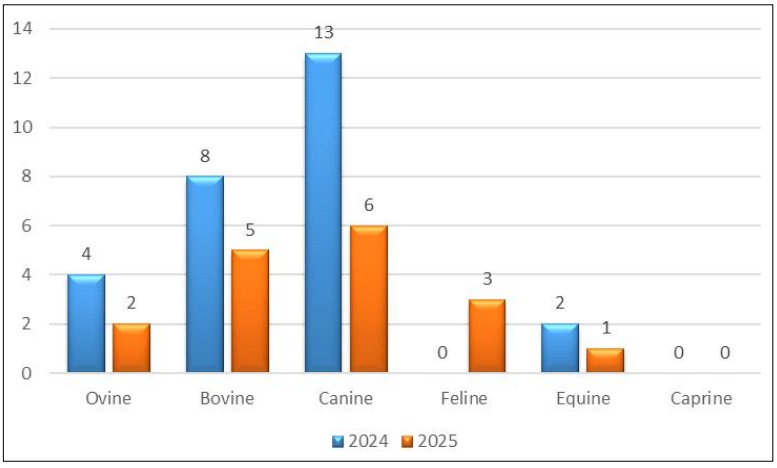


Fig 4: Distribution of rabies in animal species in the province of Batna.

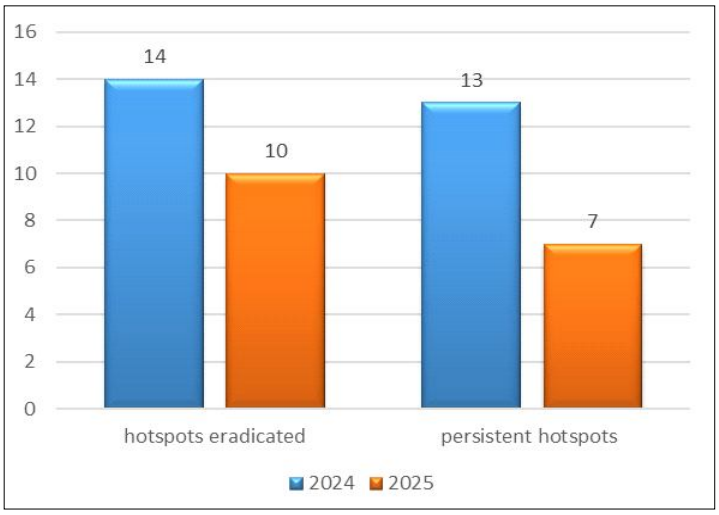


Fig 5: Rabies control program.

rabies in Algeria by focusing on the strategies adopted by countries that have already eliminated dog-mediated Rabies through successful canine rabies vaccination and One health approach.

CONCLUSION

Rabies is a zoonotic disease that poses a serious threat to both veterinary and public health and imposes a heavy social and financial burden on the Algerian state. The success of the Rabies control and elimination program depends on multi-sectoral collaboration and establishment of a surveillance system capable of capturing information about epidemiological data and laboratory information, which may be shared across sectors.

This study provides valuable information on the epidemiological situation of rabies in Batna province in order to contribute to the improvement of methods and means of controlling this disease. Overall, 44 hotspots were reported in different rural municipalities linked to agricultural activities, including herbivore farming and the use of unvaccinated dogs to guard herds. The study also highlighted the role of dogs, which accounted for 48% of cases in 2024 and 35% in 2025, as a source of infection for humans and other animals.

To complement these findings, conducting additional surveys targeting most of the Algerian provinces could allow for a more complete understanding of rabies in Algeria. These studies would contribute to the prevention of this deadly disease and to achieving the goal of “Zero human deaths due to dog-mediated rabies by 2030”.

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Disclaimers

The views and conclusions expressed in this article are solely those of the authors and do not necessarily represent the views of their affiliated institutions. The authors are responsible for the accuracy and completeness of the information provided, but do not accept any liability for any direct or indirect losses resulting from the use of this content.

Conflict of interest

The authors declare that there are no conflicts of interest regarding the publication of this article. No funding or sponsorship influenced the design of the study, data collection, analysis, decision to publish, or preparation of the manuscript.

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