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Dynamics of seasonal rabies incidence in animals in Azerbaijan

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SUMMARY

The increasing number of rabies outbreaks is currently one of the most important challenges in both human and animal health. The epidemiological and epizootic significance of rabies is determined by its absolute lethality in case of clinical manifestations, as well as global spread, latent incubation period and lack of specific treatment. Rabies is endemic in Azerbaijan; wild carnivores, stray dogs and cats determining the natural type of rabies are considered the main source of infection in the Republic. The dynamics of rabies natural cases has seasonal variability. As a rule, the number of disease cases increases in autumn, winter and spring, which is associated with the biological characteristics of the main disease vectors and the climatic conditions in the region. The main purpose of the study was to investigate the spread of rabies in Azerbaijan in different seasons of the year. For this purpose, the statistical data were collected based on animal incidence by month and season for the last four years (2018–2021). It was found that rabies cases were most often identified in the period from March to May: in 2018 – 21 (31%) cases, in 2019 – 24 (38%) cases, in 2021 – 8 (40%) cases. The exception was 2020, when the majority of rabies cases occurred in December – February. To assess the epizootological and epidemiological risks of rabies in the country, the disease frequency rate among various animal species was studied by year. The largest number of rabies cases (54%) was shown to be detected among dogs. Cattle accounted for 38.1% of cases, 5.7% of positive samples were derived from stray dogs, 1.6% – from sheep, 0.6% – from horses. The study results have shown that animal rabies exhibits a clearly pronounced seasonal pattern in the Republic of Azerbaijan.

Keywords: rabies, epizootic situation, seasonality, incidence, dynamics

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Динамика сезонной заболеваемости животных бешенством в Азербайджане

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РЕЗЮМЕ

На сегодняшний день одной из важнейших проблем как здравоохранения, так и ветеринарии является растущее количество очагов рабической инфекции. Эпидемиолого-эпизоотическая значимость бешенства определяется абсолютной летальностью при условии проявления клинических признаков, повсеместным распространением, латентным инкубационным периодом и отсутствием средств специфического лечения. В Азербайджане бешенство является эндемичным заболеванием, основным источником вируса считаются дикие плотоядные животные, бродячие собаки и кошки, обуславливающие природный тип инфекции в республике. Обычно динамика естественных случаев бешенства имеет сезонную изменчивость. Как правило, число случаев заболевания увеличивается осенью, зимой и весной, что связано с биологией основных переносчиков болезни и природно-климатическими условиями региона. Основной целью исследования было изучение распространения бешенства на территории Азербайджана в разные сезоны года. Для этого были собраны статистические данные за последние 4 года (2018–2021 гг.) с учетом заболеваемости животных по месяцам и сезонам. Установлено, что случаи заболевания бешенством чаще всего регистрировались в период с марта по май: в 2018 г. – 21 (31%), в 2019 г. – 24 (38%), в 2021 г. – 8 (40%). Исключение составил 2020 г., когда пик заболеваемости пришелся на декабрь – февраль. Для оценки эпизоотологических и эпидемиологических рисков возникновения бешенства в стране была изучена частота встречаемости заболевания среди животных разных видов по годам. Показано, что наибольшее количество случаев бешенства (54%) было выявлено среди собак. На долю крупного рогатого скота приходилось 38,1% случаев, 5,7% позитивных проб составляли образцы от бездомных собак, 1,6% – от овец, 0,6% – от лошадей. Результаты исследований показали, что заболевание бешенством животных на территории Азербайджанской Республики имеет четко выраженную сезонность.

Ключевые слова: бешенство, эпизоотическая ситуация, сезонность, заболеваемость, динамика

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INTRODUCTION

The World Health Organization (WHO) and other international organizations have set a goal to eliminate human deaths due to dog rabies by 2030. Despite detailed information on such a dangerous disease as rabies in the media, there is still a need to increase public awareness [1–4].

Humans, as a rule, become infected via the bite of a rabies-infected animal, most commonly dogs, cats, rabbits, ferrets, foxes, wolves, raccoons, bats, etc. [5–7].

Rabies is an endemic disease and is subject to mandatory reporting throughout the territory of Azerbaijan. Wild carnivores, stray dogs and cats are considered the main source of the virus and cause the natural type of rabies in the Republic [8]. The characteristics of stray dog populations (density, growth dynamics, etc.), most frequently causing infection in humans, are unknown [9–11]. Therefore, conducting research and epidemiological studies is important for disease control [12–14].

The number of stray dogs in Azerbaijan is currently quite large. Rabies cases in animals that attack people are registered annually. At the same time, bites of stray dogs are considered the main etiological factor [14–16]. The current program for managing the population of these animals is to conduct sterilization and vaccination against rabies. Killing of animals has been prohibited in Azerbaijan since the "European Convention for the Protection of Pet Animals"[1] was adopted in the country. Hence, it is very important to control the spread of zoonotic diseases (mainly, rabies) throughout the country, as well as in the population of stray and feral dogs bearing a number of problems with socio-economic, religious, environmental and political consequences [3, 9, 15].

Not enough studies have been conducted in Azerbaijan to assess the risks of the pathogen's spread. In addition to the fact that stray dogs are the main cause of human infection in the settlements of the Republic, forest areas on the border with other countries are considered risk zones. Epizootological monitoring, laboratory diagnosis, vaccination and public awareness campaigns are carried out in Azerbaijan within implementation of measures aimed at the disease elimination [17, 18].

According to the Ministry of Health of Azerbaijan, 18,702 cases of animal-bites in humans were registered in 2016, 18,470 cases in 2017, 31,060 cases in 2018, 40,234 cases in 2019 and 21,671 cases in 2020 were recorded. According to the data of the Center for Surveillance of Highly Dangerous Infections, in 2016 there were 7 human deaths caused by rabies, in 2017 – 3 cases, in 2018 – 5 cases, in 2019 – 5 cases, in 2020 – 2 cases. Despite the measures taken, the problem of rabies incidence is still relevant, so it is necessary to conduct risk analysis of rabies virus spread.

Table
Dynamics of seasonal rabies incidence in animals in 2018–2021

Year	Number of rabies cases				
	December – February	March – May	June – August	September – November	Total
2018	16	21	17	14	68
2019	18	24	8	13	63
2020	17	5	3	4	29
2021	4	8	4	4	20
Total	55	58	32	35	180

This study was aimed at investigating the dynamics of animal rabies transmission depending on the season. For this purpose, statistical data on animal disease cases in the Republic were analyzed for the period from 2018 to 2021.

MATERIALS AND METHODS

Seasonal changes in the population size, behavior and physiological parameters of animals are considered to be the factors that significantly affect the spread of wild animal diseases [19, 20]. Understanding the basic mechanisms and forecasting the seasonal spread of animal diseases such as rabies is crucial for the implementation and optimization of strategies aimed at their control [21, 22]. To determine the seasonal dynamics of rabies, the statistical data were collected for the last 4 years (2018–2021), taking into account the morbidity of animals by month and season. The rabies incidence in different animal species for the specified period was calculated based on the data provided by the National Veterinary Laboratory.

Rabies laboratory diagnosis is performed in accordance with the Guidelines on Diagnostic Tests and Vaccines for Terrestrial Animals of the World Organization for Animal Health (WOAH)[2]. The pathogen is identified using the fluorescent antibody test (FAT), which is considered the screening method. Positive samples are confirmed using polymerase chain reaction (PCR) [23].

TEST RESULTS

The table shows data on seasonal rabies incidence in animals for the last 4 years (2018–2021).

[1] European Convention for the Protection of Pet Animals (ETS No. 125). Available at: https://www.coe.int/ru/web/conventions/by-member-states-of-the-council-of-europe?module=treaty-detail&treatynum=125.

[2] Rabies (Infection with Rabies Virus and other Lyssaviruses). *In: WOAH. Manual of Diagnostic Tests and Vaccines for Terrestrial Animals.* Chapter 3.1.18. Available at: https://www.woah.org/fileadmin/Home/eng/Health_standards/tahm/3.01.18_RABIES.pdf.

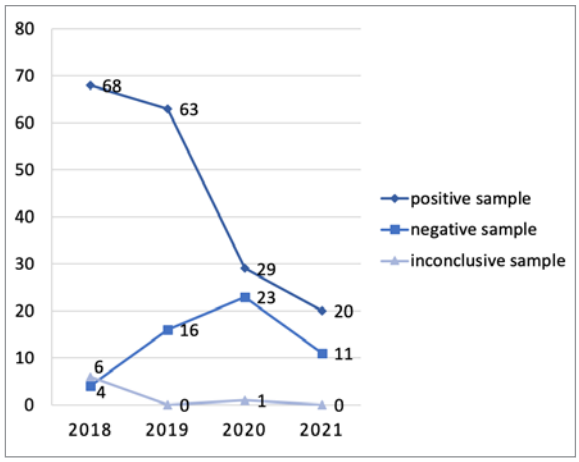


Fig. 1. Brain samples of suspected rabies cases submitted to the laboratory in 2018–2021

It was found that rabies cases were most often registered in the period from March to May: 21 (31%) cases – in 2018, 24 (38%) cases – in 2019, 8 (40%) cases – in 2021. The exception was 2020, when the majority of rabies cases occurred in December – February: 17 positive results were obtained, which constituted 59%.

Figure 1 shows test results for 241 brain samples submitted to the laboratory from rabies-suspected animals in 2018–2021. Among them, 180 samples were positive, 54 samples were negative, 7 samples were deteriorated and could not be tested due to late delivery to the laboratory.

To assess the epizootological and epidemiological risks of rabies in the country, the frequency of the disease occurrence among animals of different species by year was studied (Fig. 2). The statistical data provided by the National Veterinary Laboratory was analyzed and presented in the form of a graph reflecting information on rabies detection cases among different animal species for the period from 2018 to 2021.

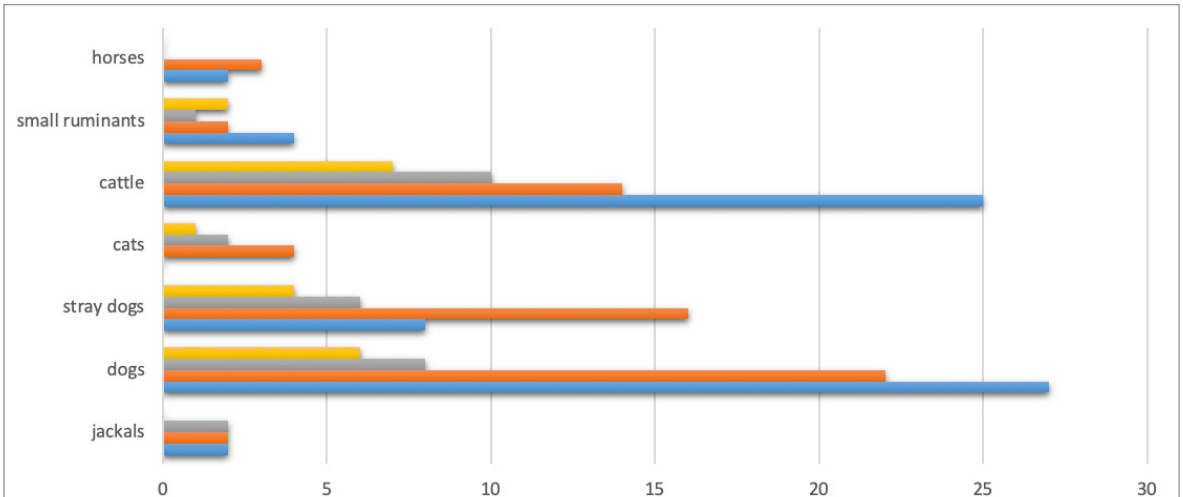
In total, during the period under review, out of 180 positive results in the December – May season, the largest number of rabies cases (54%) were detected in dogs. The share of cases in cattle accounted for 38.1%, 5.7% of positive samples were received from stray dogs, 1.6% – from sheep, 0.6% – from horses.

DISCUSSION

According to the generally accepted knowledge, natural rabies epizootics are characterized by seasonal variability. As a rule, the number of disease cases increases in autumn, winter and spring [24–26]. The highest frequency of rabies cases in our study was detected in the period from December to May 2018–2021. There is a possibility that this is due to the beginning of the bat breeding season [27]. It can be noted that the decrease in the number of rabies cases in 2020–2021 coincides with large-scale vaccination campaigns for pet dogs [18]. The revealed trend of seasonal morbidity requires further study in order to develop an effective strategy of rabies control.

Other expected causes of seasonal fluctuations in the incidence of animal infectious diseases are climatic conditions, frequency of breeding cycles, migration and lack of food [22]. Although domestic dogs do not exhibit seasonal breeding tendencies, under certain conditions their mating activity during the year may have a wave-like character [28].

The analysis of epizootological data and the laboratory test results allowed us to establish the nature of rabies seasonality in Azerbaijan. The monthly dynamics of incidence was revealed with the highest indicators in the period from December to May and the lowest – from June to September. These results are consistent with the recommendations on the scheme of preventive anti-rabies vaccination of pet dogs [18].



	jackals	dogs	stray dogs	cats	cattle	small ruminants	horses
2021	0	6	4	1	7	2	0
2020	2	8	6	2	10	1	0
2019	2	22	16	4	14	2	3
2018	2	27	8	0	25	4	2

Fig. 2. Incidence of rabies in different animal species in 2018–2021

CONCLUSION

The study results have shown that animal rabies has a clearly pronounced seasonality in the territory of the Republic of Azerbaijan. It was found that during the analyzed period, the largest number of animal rabies cases were recorded in the spring period, which is highly likely to be related to the animal breeding season.

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