

Abutalip A., Doctor of Veterinary Sciences, Professor, **the main author**, <https://orcid.org/0000-0002-2724-8220>

«Kazakh Scientific Research Veterinary Institute» LLP, 223 Rayymbek Avenue, Almaty, Republic of Kazakhstan, aspen_vet@mail.ru

Kanatbayev S. G., Doctor of Biological Sciences, Professor, <https://orcid.org/0000-0003-0640-4316>
«West Kazakhstan Scientific Veterinary Station» branch of «Kazakh Scientific Research Veterinary Institute» LLP, 52/1, Gagarina str., Uralsk, Republic of Kazakhstan, serik_kg@mail.ru

Daugaliyeva A.T., Candidate of Veterinary Sciences, Associate Professor, <https://orcid.org/0000-0003-0640-4316>

«Kazakh Research Institute for Livestock and Fodder Production» LLP, st. Zhandosova 51, Almaty, Republic of Kazakhstan, aida1979@bk.ru

Daugaliyeva S.T., <https://orcid.org/0000-0002-8826-3942>

«Scientific Production Center of Microbiology and Virology» LLP, Bogenbai Batyr str., 105, Almaty, Republic of Kazakhstan, saule.daugaliyeva@mail.ru

Semenenko M. P., Doctor of Veterinary Sciences, Associate Professor,
«Krasnodar Research Center for Animal Husbandry and Veterinary Medicine»FSBI, 1st Line st., 1, Krasnodar, Russian Federation, sever291@mail.ru.

Adilov A.D., Master of veterinary Sciences, <https://orcid.org/0000-0002-5017-6827>

«West Kazakhstan Scientific Veterinary Station» branch of «Kazakh Scientific Research Veterinary Institute» LLP, 52/1, Gagarina str., Uralsk, Republic of Kazakhstan, ada_kz@mail.ru

Shakibayev E. B., PhD doctoral student, <https://orcid.org/0000-0002-2221-235X>

«Kazakh Scientific Research Veterinary Institute» LLP, 223 Rayymbek Avenue, Almaty, Republic of Kazakhstan, shakibaev.erden@mail.ru

Orynbayeva B.M., Graduate student, <https://orcid.org/0009-0008-1949-0990>

«South Kazakhstan University named after M. Auezov» , M.H.Dulati 198, Shymkent, Republic of Kazakhstan, bibizada1991@mail.ru

RETROSPECTIVE ANALYSIS OF THE EPIZOOTIC SITUATION OF BRUCELLOSIS IN THE WEST KAZAKHSTAN REGION

ANNOTATION

Brucellosis is one of the most widespread zoonotic infectious diseases of farm and wild animals, capable of infecting humans through contact with animals or animal products, especially in regions with intensively developed livestock farming, such as the Republic of Kazakhstan. This disease significantly reduces livestock productivity, thereby damaging the country's economy. Kazakhstan is an endemic country, and cases of the disease are registered annually in animals and humans. The causative agent of brucellosis is a potential biological warfare agent, classified as category B.

The article presents research results on the epizootic situation of animal brucellosis in the West Kazakhstan region for 2019-2023. The leading role of cattle, sheep, and goats in the epizootiology of brucellosis in the West Kazakhstan region has been established, the almost ubiquitous spread of brucellosis in the areas has been noted, and the most significant reasons contributing to the emergence and maintenance of the problem of animal brucellosis have been identified. Based on the results of epizootological monitoring, an epizootic zoning map of the territories of the West Kazakhstan region districts has been compiled according to the degree of animal brucellosis incidence into various categories (with high, medium, low degree and safe zones) in which appropriate differentiated anti-epizootic measures will be carried out.

Key words: *brucellosis, morbidity, diagnostic studies, epizootiology monitoring, epizootic situation, epizootic chart.*

Introduction. In the Republic of Kazakhstan, brucellosis is a widespread, economically, and socially significant disease [1, 2].

For many years, brucellosis has dominated the infectious pathology of cattle, sheep, and goats in the Republic of Kazakhstan, significantly reducing livestock. Despite all the measures taken by veterinary specialists to eliminate brucellosis infection, the epizootic situation for this disease remains tense [3, 4, 5].

In the fight against animal brucellosis, epizootiology monitoring is the essential element and information basis for optimizing the anti-epizootic measures taken and increasing their effectiveness. The results of long-term monitoring studies on brucellosis in animals allow us to assess the actual state of the epizootic situation and determine the degree of risk of this disease not only in the regions and districts of the country but also in each epizootiology unit [7,8].

Considering the unresolved problem of combating animal brucellosis in the Republic of Kazakhstan, our research aimed to analyze the epizootic situation for brucellosis in cattle, sheep, and goats in the context of the West Kazakhstan region over the past 5 years to compile epizootic maps of zoning the territory of the West Kazakhstan region according to the degree of spread of the disease, to determine the leading causes of occurrence and to search for perfect ways to combat this disease.

Materials and methods of research. The research was conducted in the brucellosis laboratory of the West Kazakhstan Research Veterinary Station, veterinary organizations, and livestock farms of the West Kazakhstan region.

The materials for the research were official data of veterinary reporting of the Committee for Veterinary Control and Supervision of the Ministry of Agriculture of the Republic of Kazakhstan, the Republican anti-epizootic detachment, the regional branch of the republican veterinary laboratory, the Republican State Enterprise on the Right of Economic Management, the Scientific and Practical Center for Sanitary and Epidemiological Examination and Monitoring of the Ministry of Health of the Republic of Kazakhstan and the results of the authors' epizootiology studies.

In the course of the research work, officially regulated methods of research for the diagnosis of animal brucellosis were used: epizootiology, bacteriological, biological, and serological "Methodological guidelines for laboratory diagnostics of brucellosis," officially regulated by the Veterinary legislation of the Republic of Kazakhstan, Astana, 2005 [9].

The epizootic situation for animal brucellosis was analyzed using the methods described by Dudnikov, S. A. [10], and Dzhupina, S. I. [11].

To study the epizootic manifestation of brucellosis infection and improve the system of epizootological control for this disease, the following were analyzed:

- results obtained by the staff of the brucellosis laboratory during epizootiology and immunological monitoring and control over animal brucellosis in the districts of the region;
- statistical reviews and official reports on veterinary welfare for animal brucellosis of the regional territorial inspection of the Committee for Veterinary Control and Supervision of the Ministry of Agriculture of the Republic of Kazakhstan, the Republican State Enterprise "Republican Anti-Epizootic Detachment," and the "Republican Veterinary Laboratory."

To zone the territory of the region taking into account epizootiology indicators, retrospective data on the degree of prevalence and incidence of animal brucellosis over several years were used, epizootiology maps of the spread of brucellosis in the Western Kazakhstan region were analyzed and compiled.

When compiling epizootiology zoning maps of the territory of the West Kazakhstan region, retrospective data on the degree of prevalence of animal brucellosis from 2019 to 2023 (with high, medium, and low risk) were considered. Modern techniques based on Geographic Information Systems - technologies and methodology for assessing the risks of the emergence and spread of diseases, taking into account the recommendations of the OIE, were used.

Results and their discussion. This work aimed to monitor and analyze the epizootiology of animal brucellosis in West Kazakhstan for 2019-2023.

The materials collected on this issue for analysis were summarized in tables, which are shown in the tables and figures below.

Table 1 – Information on the number of epizootic foci of infectious animal diseases in the West Kazakhstan region for 2019-2023

Epizootic indicators	2019	2020	2021	2022	2023	In 5 years	On average, over 5 years
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Total number of epizootic outbreaks of infectious animal diseases	45	84	54	14	11	208	41
Number of epizootic foci of brucellosis in cattle	13	13	20	0	3	49	9,8
Number of epizootic foci of brucellosis in sheep and goats	3					3	0,6
The share of brucellosis in the total number of epizootic foci (%)	35,5	15,5	37,03	0	27,3	25,0	28,06

As seen from Table 1, in the West Kazakhstan region for 2019-2023, the share of brucellosis in the total number of epizootic foci of infectious animal diseases ranged from 15.5 to 37.03%. During these years, 49 epizootic foci of bovine brucellosis and three foci of sheep and goat brucellosis were registered in 2019. The most significant number of foci of bovine brucellosis were in the Syrymsky (10), Karatobinsky (9), Baitereksky (8), and Chingirlausky (6) districts of the region.

Figure 1 shows the epizootic foci of infectious animal diseases in West Kazakhstan from 2019 to 2023.

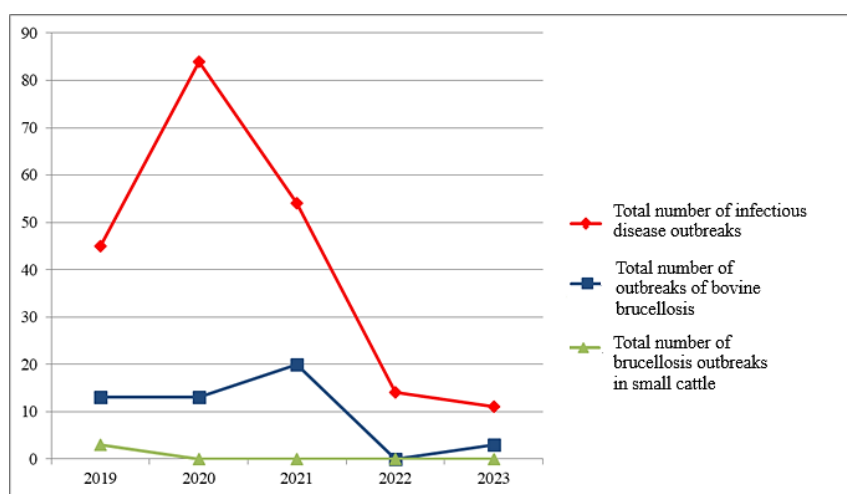


Figure 1 – Dynamics of epizootic foci of infectious animal diseases in the West Kazakhstan region for 2019-2023

Figure 1 shows that many foci of cattle brucellosis occurred mainly in 2019-2021, in 2022 - 0, and 2023, the number of foci decreased to 3. Foci of sheep and goat brucellosis occurred only in 2019, and they were not registered in subsequent years. Since 2021, there has also been a tendency to decrease the number of epizootic foci of infectious diseases in the West Kazakhstan region from 54 to 11.

Next, we collected and analyzed the indicators of the incidence rate of animals in the West Kazakhstan region for 2019-2023. Table 2 shows that in the West Kazakhstan region, in terms of the incidence of brucellosis on average over the past 5 years, animals are ranked as follows: carnivores (3.9%), camels (0.97%), cattle (0.74%), sheep and goat (0.08%), horses (0.04%) and pigs (0.0%).

Table 2 – Incidence and absolute number of animals diagnosed with brucellosis in the West Kazakhstan region for 2019-2023

Years	Cattle		Sheep and goat		Camels		Horses		Pigs		Dogs	
	Number of sick	sick, %	Number of sick	sick, %	Number of sick	sick, %	Number of sick	sick, %	Number of sick	sick, %	Number of sick	sick, %
2019	7008	0,99	1340	0,09	3	0,15	0	0	0	0	46	4,02
2020	6068	0,9	1463	0,12	1	0,09	2	0,2	0	0	84	5,30
2021	6180	0,81	1160	0,11	15	1,56	0	0	0	0	47	3,68

2022	4786	0,62	780	0,05	11	1,12	0	0	0	0	61	4,80
2023	4141	0,50	793	0,05	20	1,97	0	0	0	0	26	1,96
In 5 years	28183		5536		50		2		0		264	
On average, over 5 years	5637	0,74	1107	0,08	10	0,97	0,4	0,04	0	0	53	3,9

The higher incidence of brucellosis in carnivores (3.9%) compared to other animal species can be explained by the fact that only a limited number of animals were examined, mainly flock dogs in farms unfavorable for brucellosis, during anti-brucellosis health measures. Over the past 5 years, an average of 1,180 camels have been reviewed for brucellosis annually; the incidence rate was 0.9%). It should be noted that camels were kept together with cattle, sheep, and goats on all farms. Next in terms of incidence of brucellosis are cattle (0.74%), sheep and goats (0.08%), and horses (0.04%).

In terms of the absolute number of animals diagnosed with brucellosis on average over 5 years, cattle, sheep, and goats were in the first place (28,183 and 5,536 heads, respectively), which predetermined the central role of these animal species in the epizootiology of brucellosis. The second role in the epizootiology of animal brucellosis in the West Kazakhstan region is played by camels and dogs. The average incidence rate of horses over 5 years was - 0.04%, and pigs - 0.0%, which indicates the absence of a role for these animal species in the epizootiology of brucellosis in the West Kazakhstan region.

Figure 2 shows the dynamics of brucellosis infection in different animal species in the West Kazakhstan region in recent years.

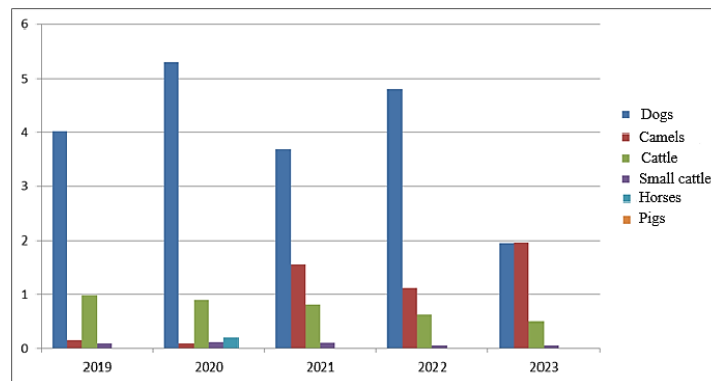


Figure 2 – Dynamics of animal brucellosis incidence in the West Kazakhstan region for 2019-2023

Figure 2 shows that the highest incidence of brucellosis over these years was observed in dogs (1.9-5.3%), camels (0.1 - 1.9%), cattle (0.5 - 0.9%), sheep, and goats (0.05 - 0.1%). Equine brucellosis was registered only in 2020. All animal species in 2023, compared to 2019, except for camels, showed a specific decrease in the incidence of brucellosis. Camels continue to have a high incidence rate in 2021-2023, which should alert the veterinary service and serve as a signal for organizing specific anti-brucellosis measures.

Table 3 – Diagnostic studies of cattle for brucellosis in the West Kazakhstan region in 2019-2023

Name of districts	Number of patients with brucellosis and incidence rate, in %												
	2019		2020		2021		2022		2023		For 5 years		
	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity, total	Average number per year	%, on average per year
Akzhaik	681	0,6	557	0,6	590	0,6	421	0,3	267	0,2	2516	503	0,46
Baiterek	797	2,2	779	2,3	490	1,1	528	1,2	292	0,6	2886	577	1,48
Bokeyordinsky	637	0,8	885	1,0	988	1,2	503	0,7	380	0,5	3393	679	0,84
Burlinsky	309	1,0	202	0,6	103	0,3	119	0,4	145	0,4	878	176	0,54
Zhangalinsky	305	0,5	175	0,3	122	0,2	252	0,4	286	0,4	1140	228	0,36
Zhanibeksky	536	1,3	250	0,5	408	0,8	250	0,5	234	0,4	1678	335	0,7
Kaztalovsky	740	0,8	741	0,9	999	1,0	679	0,7	604	0,6	3763	752	0,8
Karatobinsky	878	2,1	632	1,4	408	1,1	270	0,6	256	0,6	2444	488	1,16
Syrymsky	985	2,4	651	1,1	999	1,7	706	1,2	506	0,8	3847	769	1,44
Taskalinsky	390	1,4	256	1,6	315	1,0	233	0,7	373	1,0	1567	313	1,14
Terektinsky	572	1,2	729	1,2	513	0,8	647	1,2	458	0,7	2919	584	1,02
Shyngyrlausky	160	0,4	181	0,4	229	0,5	172	0,4	77	0,2	819	164	0,38
Uralsk city	18	2,3	30	0,8	16	0,4	60	1,6	33	0,7	157	31	1,16
Total	7008	0,99	6 068	0,9	6180	0,81	4786	0,62	4141	0,5	28185	5637	0,74

Table 4 – Diagnostic studies of sheep and goats for brucellosis in the West Kazakhstan region in 2019-2023

Name of districts	Number of patients with brucellosis and incidence rate, in %												
	2019		2020		2021		2022		2023		For 5 years		
	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity	%	Quantity, total	Average number per year	%, on average per year
Akzhaik	512	0,21	551	0,30	521	0,2	189	0,08	218	0,1	1991	398	0,2
Baiterek	54	0,08	278	0,45	512	0,7	214	0,34	114	0,2	1172	234	0,35
Bokeyordinsky	9	0,01	15	0,02	0	0	0	0,00	11	0,0	35	7	0,06
Burlinsky	323	1,42	64	0,28	41	0,1	25	0,07	0	0,0	453	91	0,37
Zhangalinsky	103	0,05	27	0,02	100	0,06	9	0,01	40	0,0	279	56	0,02
Zhanibeksky	7	0,01	1	0,02	10	0,01	1	0,01	0	0,0	19	4	0,01
Kaztalovsky	27	0,01	53	0,02	6	0,01	0	0,00	2	0,0	88	17	0,01
Karatobinsky	118	0,13	225	0,32	149	0,2	0	0,00	110	0,1	602	120	0,15
Syrymsky	94	0,09	105	0,13	207	0,2	60	0,06	30	0,0	496	99	0,09
Taskalinsky	0	0,00	0	0,00	0	0	42	0,05	29	0,0	71	14	0,01
Terektinsky	55	0,07	118	0,17	193	0,2	221	0,26	94	0,1	681	136	0,16
Shyngyrlausky	20	0,05	14	0,04	21	0,0	8	0,01	26	0,0	89	18	0,02
Uralsk city	18	0,45	12	0,30	3	0,1	13	0,27	22	0,6	68	13	0,3
Total	1340	0,09	1 463	0,12	1160	0,11	780	0,05	793	0,05	5536	1107	0,08

Considering the central role of cattle, sheep, and goats in the epizootiology of brucellosis, the epizootological situation of cattle, sheep, and goats' brucellosis in the West Kazakhstan region for 2019-2023 was studied. The materials collected on this issue for analysis were summarized in tables, which are shown in Tables 3-4 below.

As can be seen from Table 3, in recent years (from 2019 to 2023), a high incidence of cattle brucellosis has been observed in the Baiterek district, Syrymsky, Karatobinsky, Taskalinsky, Terekty, Bokeyordinsky, Kaztalovsky districts and in the city of Uralsk. Cattle brucellosis during this period was registered in 7 districts of the region (58.3% of the region's territory); in these districts, 4162 heads of cattle sick with brucellosis were identified, which is 73% of the total number of livestock sick identified over 5 years. The number of all positively reacting cattle identified for 2019-2023 and the level of their infection with brucellosis are given in Table 5.

Table 5 – Number of positively reacting cattle for the period 2019-2023 and their level of infection with brucellosis

Epizootological indicators	Years					On average, over 5 years
	2019	2020	2021	2022	2023	
Number of positive responders	7008	6 068	6180	4786	4141	5636
% infection	0,99	0,9	0,81	0,62	0,5	0,7

Table 5 shows that the number of positively reacting animals detected has been trending downward since 2019 (from 7008 to 4141 heads), and their brucellosis infection has decreased from 0.9 to 0.5%.

Next, using the obtained epizootiology monitoring results, the region's territory was ranked according to the degree of infection with bovine brucellosis. In this case, the starting point was the average regional incidence rate of bovine brucellosis over these years, equal to - 0.74%. Districts with an incidence rate of animals over 0.74% were classified as zones with a high incidence rate of brucellosis, and those below were classified as zones with an average or low incidence rate of brucellosis. Territories where no animals with brucellosis were detected were considered a favorable zone (Table 6).

Table 6 – Ranking of the West Kazakhstan region by the degree of infection with cattle brucellosis for 2019-2023

No. in order	Brucellosis incidence rate (average over 5 years – 0.74%)	Name of the districts and level of animal infestation, in %
1	High degree (from 0.74% and above) is registered in 7 districts (58.3% of the region's territory)	Baiterek - 1.48%, Syrymsky -1.44%, Karatobinsky - 1.16%, Taskalinsky - 1.14%. Terektinsky - 1.02%. Bokeyordinsky - 0.84%, Kaztalovsky - 0.8%
2	Average degree (from 0.5% to 0.7%), registered in 2 districts (16.6%)	Zhanibeksky - 0.7%, Burlinsky - 0.54%
3	Low degree (from 0.01% to 0.49%), registered in 3 districts (25%)	Akzhaik - 0.46%, Shyngyrlau -0.38%, Zhanalinsky - 0.36%
4	Safe zone (0.0%)	No

Table 6 shows that a high incidence of brucellosis in cattle is registered in 7 districts (58.3% of the region's territory) and the city of Uralsk, an average incidence in 2 districts (16.6%), and a low incidence in 3 districts (25%). There is no safe zone.

An epizootic zoning map of the republic's territory by incidence of brucellosis in cattle for 2019-2023 was compiled to demonstrate the data obtained visually.

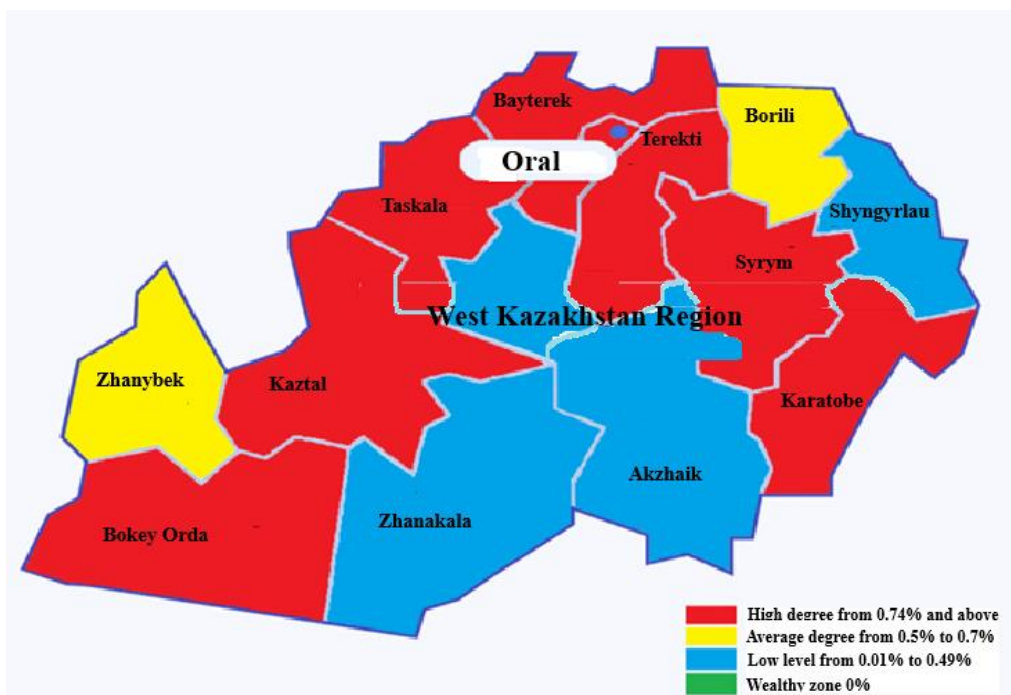


Figure 3 – Zoning of the territory of the West Kazakhstan region by the incidence rate of cattle by districts for 2019-2023

Next, to analyze the epizootic situation for brucellosis in sheep and goats, we collected and summarized data on diagnostic studies over the past 5 years (Table 4).

Table 4 shows that the incidence rate of brucellosis in sheep and goats by region districts over these years varied from 0.01 to 0.37%. A high percentage of brucellosis in sheep and goats for 2019-2023 was registered in 6 districts of the region (50% of the region's territory); during this period, 5,395 heads of sheep and goats sick with brucellosis were identified in these districts, which is 97.4% of the total number of sick sheep and goats identified over 5 years.

Next, using the obtained results of epizootological monitoring, the territory of the Republic of Kazakhstan was ranked by the degree of infection with brucellosis in sheep and goats. In this case, we proceeded from the average regional incidence rate of brucellosis in sheep and goats over these years, which equals 0.08%. Districts with an incidence rate of animals above 0.08% were classified as a zone with a high incidence rate of brucellosis and below as a zone with a medium or low incidence rate. The favorable zone was where no animals were sick with brucellosis (Table 7).

Table 7 – Ranking of West Kazakhstan regions by the incidence rate of brucellosis in sheep and goats for 2019-2023

No. in order	Brucellosis incidence rate (average over 5 years – 0.08%)	Name of the districts and level of animal infestation, in %
1	High degree (0.08% and above), registered in 6 districts (50% of the territory of the Republic of Kazakhstan)	Burlinsky - 0.37%, Baitereksky - 0.35%, Akzhayiksky - 0.2%, Terektinsky - 0.16%, Karatobinsky - 0.15%, Syrymsky - 0.09%
2	Low degree (from 0.01% to 0.06%), registered in 6 districts (50%)	Bokeyordinsky - 0.06%, Zhanalinsky - 0.02%, Shyngyrlausky - 0.02%, Zhanibeksky - 0.01%, Kaztalovsky - 0.01%, Taskalinsky - 0.01%
3	Safe zone (0.0%)	No

As can be seen from Table 7, over 5 years, the status of a high degree of spread of brucellosis in sheep and goats was registered in 6 districts (50% of the region's territory), and the city of Uralsk in

6 districts (50%) the incidence of animals was low. There were no districts favorable for brucellosis in sheep and goats.

An epizootiology zoning map of the territory of the West Kazakhstan region showing the incidence of brucellosis in sheep and goats from 2019 to 2023 was compiled to demonstrate the data obtained clearly.

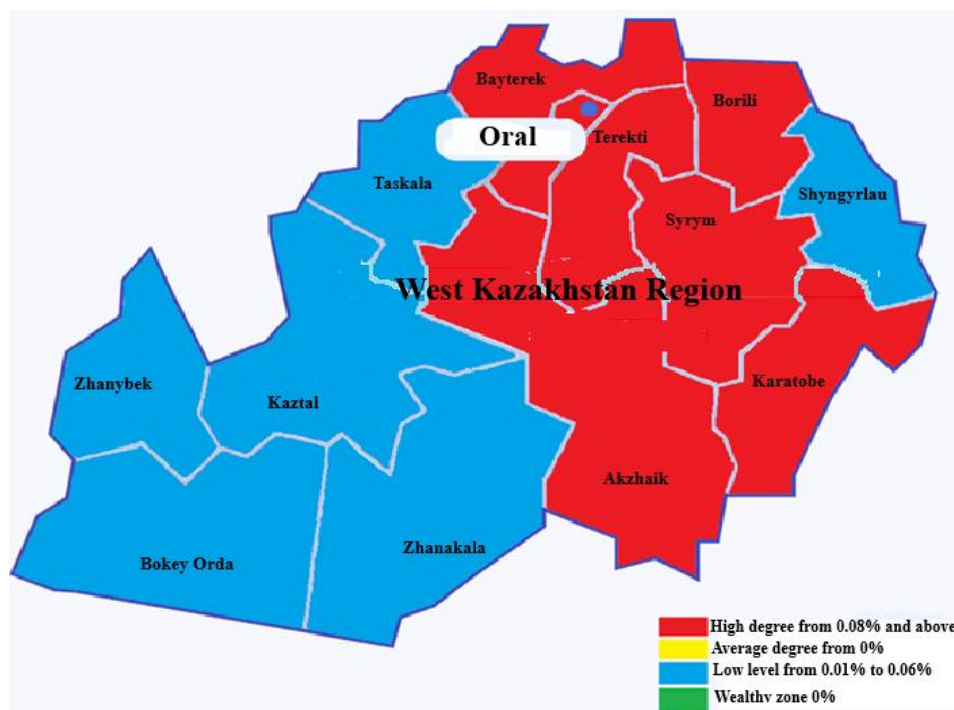


Figure 4 – Zoning of the territory of the West Kazakhstan region by the incidence rate of small ruminants by districts for 2019-2023

Thus, the compiled epizootological maps will replenish the catalog of similar maps developed annually, allow visualizing the spread of brucellosis in cattle and small ruminants, track the expansion or decrease in the area of distribution of brucellosis in animals in the region, and carry out epizootological control over the development of brucellosis infection in areas with different epizootological statuses.

In the process of epizootological monitoring and studying the epizootic situation for brucellosis in cattle and small ruminants, we have established the most significant reasons contributing to the persistence of problems with brucellosis in animals in certain areas of the region; these are incomplete coverage of diagnostic studies of agricultural animals in some areas; concealment of cases of abortion in animals by owners, failure to inform veterinary specialists about the incident and failure to provide pathological material to a veterinary laboratory for testing for brucellosis and other infectious diseases; untimely declaration of a farm as unfavorable; untimely isolation and delivery of sick animals for slaughter; keeping animals of different species and different age and sex groups in a herd; contact on pastures and at watering places of animals from unfavorable and successful farms, etc.

During the reporting period, we also studied the epidemiological situation of brucellosis in humans in West Kazakhstan from 2019 to 2023.

From Table 8, it is clear that for 2019-2023, however, there is a tendency to decrease the absolute number of cases of newly diagnosed brucellosis in humans (from 48 to 40 people), and the incidence rate per 100 thousand people remains high (from 5.5 to 7.3). In total, 210 people fell ill with brucellosis in the West Kazakhstan region in 5 years, an average of 42 people per year. The most significant number of people with brucellosis was registered in Akzhaik (97), Baiterek (20), Shyngyrlau (17), Burlin (16), and Zhangalinsky (14) districts and the city of Uralsk (19). Human brucellosis was registered mainly in areas where brucellosis in small ruminants and cattle has a high and medium prevalence.

Table 8 – Indicators of brucellosis incidence among the population of the West Kazakhstan region for 2019-2023T

Name of districts	2019		2020		2021		2022		2023		In 5 years	
	Absolut number	per 100 thousand population	Absolut number	per 100 thousand population	Absolut number	per 100 thousand population	Absolut number	per 100 thousand population	Absolut number	per 100 thousand population	Absolut number	per 100 thousand population
Akzhaik	20	49,7	24	60	12	30,2	17	47	24	66,7	97	50,72
Baiterek	3	5,1	1	1,7	9	14,9	7	11,7	0	0	20	6,68
Bokeyordinsky	1	6,6	0	0	0	0	0	0	0	0	1	1,32
Burlinsky	5	8,8	2	3,5	3	5,3	6	10,2	0	0	16	5,56
Zhangalinsky	4	16,6	2	8,3	3	12,4	2	10,2	3	12,5	14	12,0
Zhanibeksky	1	6,20	1	6,2	3	19	0	0	0	0	5	6,28
Kaztalovsky	0	0	0	0	0	0	0	0	0	0	0	0
Karatobinsky	1	6,5	0	0	1	6,4	0	0	0	0	2	2,58
Syrymsky	1	5,3	2	10,7	2	10,8	0	0	0	0	5	5,36
Taskalinsky	0	0	0	0	1	6,0	3	8,3	2	12,2	6	5,3
Terektinsky	2	5,2	0	0	1	2,6	2	5,1	3	7,6	8	4,1
Shyngyrlausky	6	41,0	3	20,5	0	0	2	13,7	6	46,1	17	24,26
Uralsk city	4	1,2	3	0,9	2	0,6	8	2,6	2	0,6	19	1,18
By region	48	7,3	38	5,7	37	5,5	48	7,0	40	5,7	210	6,24

Based on the data analysis in Table 8, an epidemiological zoning map of the territorial distribution of human brucellosis in the West Kazakhstan region was compiled (Figure 5).

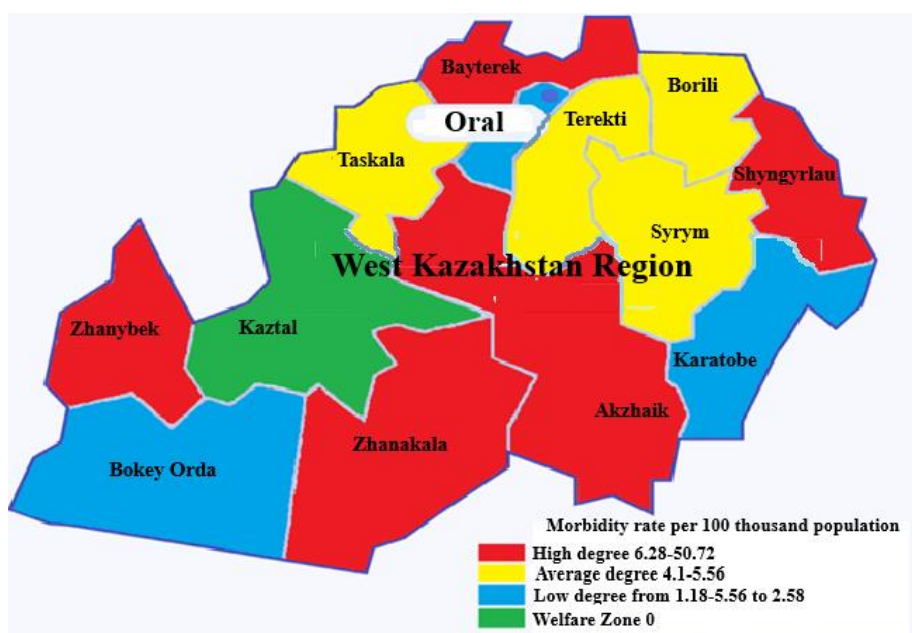


Figure 5 – Zoning map of the territorial distribution of human brucellosis in the West Kazakhstan region for 2019-2023

Figure 5 shows that higher rates per 100,000 population are observed in Akzhayik (50.7), Shyngyrlau (24.3) and Zhangelinsky (12.0) districts. Analysis of the territorial distribution of human brucellosis and the incidence of small ruminants (to a greater extent) and cattle shows a coincidence, which once again confirms the role of farm animals in preserving and circulating brucellosis infection in the West Kazakhstan region.

Animal brucellosis is widespread in many countries and causes enormous economic damage to livestock and the economy. According to the OIE, brucellosis is found in 28 European countries, 18 in America, 12 in Asia, and 21 in Africa. In the Commonwealth of Independent States, animal brucellosis is common in Kyrgyzstan, Kazakhstan, Russia, Azerbaijan, and Uzbekistan [12].

Brucellosis also affects people, where the primary source of infection is animals and products obtained from them. At the present stage, the World Health Organization (WHO) considers brucellosis to be one of the most dangerous and widespread zoonoses in the world. Over 500 thousand cases of human disease are registered annually in more than 170 countries. According to the WHO, the number of people infected annually can be estimated at 5–12.5 million cases. In modern realities, with the global spread of brucellosis among animals, the possibility of human disease is not excluded for any of the countries due to the risk of the presence of a source of infection in a given territory or a territory bordering it [13,14,15,16,17].

Considering the enormous epizootological and epidemiological significance of brucellosis in Kazakhstan, numerous scientific studies have been conducted on issues of monitoring, studying the biological properties of the pathogen, prevention, and control measures for brucellosis [18,19,20,21,22,23].

In this paper, the objective was to analyze the epizootic situation for brucellosis in cattle and small ruminants and the epidemic projection of brucellosis in the context of the region's districts in recent years, to determine the leading causes of this disease to compile epizootic maps of the disease zoning, which can be used by veterinary specialists when carrying out anti-brucellosis measures.

As a result, the epizootic situation for brucellosis in animals in the territory of the West Kazakhstan region was studied by analyzing official data from the Committee for Veterinary Control and Supervision of the Ministry of Agriculture of the Republic of Kazakhstan, the Republican State Enterprise "Republican Anti-Epizootic Detachment," the "Republican Veterinary Laboratory," and the results of our epizootiology studies for the period from 2019 to 2023. The incidence rate of brucellosis in cattle and small ruminants, the area of infection, prevalence, dynamics, and degree of its manifestation in the West Kazakhstan region have been determined.

It has been established that the highest incidence rate of brucellosis over these years was noted in dogs (1.9-5.3%), then in camels (0.1-1.9%), in cattle (0.5 - 0.9%), and small ruminants (0.05 - 0.1%). Brucellosis in horses was registered only in 2020. Except for camels, a specific decrease in the incidence rate of brucellosis was observed in all animal species in 2023 compared to 2019. In camels, a high incidence rate remains in 2021-2023, which should alert the veterinary service and serve as a signal for the organization of specific anti-brucellosis measures.

In terms of the absolute number of animals diagnosed with brucellosis on average over 5 years, cattle and small ruminants were in first place (28,183 and 5,536 heads, respectively), which predetermined the central role of these animal species in the epizootology of brucellosis.

From 2019 to 2023, a high incidence of cattle brucellosis was observed in the Baiterek district, Syrymsky, Karatobinsky, Taskalinsky, Terektinsky, Bokeyordinsky, Kaztalovsky districts and in the city of Uralsk, in these districts 4,162 heads of cattle with brucellosis were identified, which is 73% of the total number of livestock sick identified over 5 years, the average degree in 2 - (16.6%) and a low degree in 3 districts (25%).

Over the past five years, the high prevalence of brucellosis in small ruminants has been registered in 6 districts (50% of the region's territory). In the city of Uralsk, the incidence of animals is low in 6 districts (50%). There were no districts free of brucellosis in small ruminants and cattle.

As for the incidence of brucellosis in humans, although there is a downward trend in the absolute number of cases of newly diagnosed brucellosis in humans (from 48 to 40 people) in 2019-2023, the incidence rate per 100 thousand people remains high (from 5.5 to 7.3). In total, 210 people fell ill with brucellosis in the West Kazakhstan region over 5 years, an average of 42 people per year. Human brucellosis is registered mainly in areas where brucellosis in small ruminants and cattle has a high and medium prevalence.

Analysis of the territorial distribution of brucellosis in humans and the incidence of small ruminants (to a greater extent) and cattle shows a coincidence, which once again confirms the role of farm animals in preserving and circulating brucellosis infection in the Republic of Kazakhstan.

Conclusion. Thus, taking into account the existing problem of combating animal brucellosis in the Republic of Kazakhstan, our studies related to epizootiology and epidemiological monitoring allowed us to assess the epizootic situation of animal brucellosis objectively, identify the causes that contribute to the preservation of the problem in unfavorable foci, and spread of infection to vast territories. The results of our studies may be necessary for epidemiological and epizootiology surveillance and can be used to develop effective methods and means of combating brucellosis.

The studies established a ubiquitous spread of cattle and small ruminant brucellosis in West Kazakhstan. They determined the most significant causes contributing to preserving the problem of animal brucellosis.

Analysis of the epizootic situation of animal brucellosis in recent years indicates the leading role of cattle and small ruminants in the epizootiology of brucellosis in the West Kazakhstan region.

Analysis of official epizootiology data of the Committee for Veterinary Control and Supervision of the Ministry of Agriculture of the Republic of Kazakhstan and the Republican State Enterprise "Republican Anti-Epizootic Detachment," "Republican Veterinary Laboratory" and the information we collected from regional veterinary organizations allows us to determine some intensive indicators of the epizootic process in animal brucellosis, showing the degree of spread of brucellosis infection among animals in different areas, and can be used by veterinary specialists in planning and organizing anti-brucellosis measures for livestock.

Based on the epizootiology monitoring of brucellosis in recent years, the territory of the West Kazakhstan region is divided by the degree of animal brucellosis infection into different categories (high, medium, low, and favorable), in which appropriate differentiated anti-epizootic measures will be taken.

The developed epizootic zoning map will supplement the catalog of similar maps developed annually. The comparative analysis of these maps allows tracking the expansion or reduction of the area of dissemination of animal brucellosis in the territory of the West Kazakhstan region.

In zones with a high and medium degree of brucellosis in cattle and small ruminants, it is recommended to include specific prevention of animal brucellosis in the complex of anti-brucellosis measures using vaccines recommended by the OIE.

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REFERENCES

- 1 Abutalip, A. Epizootologicheskii monitoring brutselleza jivotnyh v RK za 2012-2014 gg. [Text] / Abutalip, A., Sultanov, A.A., Ivanov, N.P. i dr// // v kn.: Aktualnye problemy razvitiya veterinarnoi nauki: Materialy Mejdunarodnoi konferentsii, posvyashchenoi 85-letiyu Samarskoi nauchno-issledovatel'skoi veterinarnoi stantsii RASHN. - Samara, 2014. - S. 1-5.
- 2 Baramova, Ş.A. Epizootologicheskii monitoring brutselleza jivotnyh v Kazahstane [Text] / Scientific Light Vol 1, No 8 (2017) Wrocalw, Poland. ISSN 0548-7110. - S. 3-10.
- 3 Bazarbaev, M. Brutsellez jivotnyh (epizootologiya, diagnostika i profilaktika) [Tekst]: monografiya / Bazarbaev, M., Ten, V.B., Kanatbaev, S.G.- Karaganda, 2018. - 461 s.
- 4 Tuyaşev, E.K. Mery borby s brutsellëzom krupnogo rogatogo skota v Zapadno-Kazahstanskoi oblasti [Text] / E.K. Tuyaşev // Sb. nauchn. tr. KazNİVİ «Problemy teorii i praktiki sovremennoi veterinarnoi nauki». - Almaty, 2013. - T. 59. - S. 265-269.
- 5 Abdrahmanov, S.K. Otsenka epizooticheskogo protsessa i prognozirovaniye geograficheskogo rasprostraneniya brutselleza selskohozyaistvennyh jivotnyh. Materialy MNPK, ZKATU im. [Text] / S.K. Abdrahmanov // Jangir hana. Uralsk, 2012. - S. 141-146.
- 6 Abutalip, A. epidemiologia regionalis brucellosis contagionis in hodiernis condicionibus technologiae agriculturae animalis In Kazakhstan (per gradum propagationis et incidentiae) [Text] / A. Abutalip // Prospectus Scientificos. - 2024. 27(5). P. 20-31. doi: 10.48077 / scihor 5. 2024. 20.
- 7 Sultanov, A.A. Zadachi epizootologicheskogo monitoringa v Respublike Kazahstan [Text] / A.A. Sultanov// Mat. vyezdnoi zasedanii Komiteta po agrarnym voprosam Majilisa Parlamenta RK «Problemy i perspektivy obespecheniya veterinarnoi bezopasnosti jivotnovodstva v RK - Almaty, 2013. - S. 123-127.
- 8 Baramova, Ş.A. Sravnitel'naya effektivnost metodov obnaruženiya vozбудitelya brutselleza jivotnyh [Text] / Ş.A. Baramova // Materialy nauch. -prakt. konf. «Effektivnye metody diagnostiki i borby s infektsionnymi i invazivnymi zabolevaniyami jivotnyh». - Duşanbe, 2024. - S.101-112.
- 9 Metodicheskie ukazaniya po laboratornoi diagnostike brutselleza [Text] / veterinarnoe zakonodatel'stvo Respubliki Kazahstan. - Astana. - 2005.-23 s.
- 10 Dudnikov, S.A. Kolichestvennaya epizootologiya: osnovy prikladnoi epidemiologii i biostatistiki [Tekst]: monografiya [Text] / Dudnikov S.A.- Vladimir, 2005, - 459 s.
- 11 Djupina, S.İ. Teoriya epizooticheskogo protsessa. - M., 2004. - 123s.
- 12 İskandarov, M.İ. Brutsellez jivotnyh v Rossii [Tekst]: monografiya [Text] / İskandarov, M.İ., Gulyukin, M.İ., Gulyukin, A.M., İskandarova, S.S., Albertyan, M.P., Fedorov, A.İ., Sleptsov, E.S., Vinokurov, N.V., Fedorov, V.İ. - Novosibirsk: İzd. ANS «SibAK», 2017, - 286 s.
- 13 Hull N.C., Schumaker B.A. Comparisons of brucellosis between human and veterinary medicine. Infect. Ecol. Epidemiol. 2018; 8(1):1500846. DOI: 10.1080/20008686.2018.1500846.
- 14 Cross, A.R., Baldwin V.M., Roy S., Essex-Lopresti A.E., Prior J.L., Harmer N.J. Zoonoses under our noses. [Text] / Microbes Infect. 2019; 21(1):10–9. DOI: 10.1016/j.micinf.2018.06.001.
- 15 Centrum europaeum Pro Morbus Praeventionis Et Temperantiae. ECDC A morbo Notitia Custodia circumdant, atlas brucellosis. [electronic resource]. URL: <https://ecdc.europa.eu/en/brucellosis/surveillance/atlas> (o usitatius 05.02.2020).
- 16 Algeria 360: Tiaret: Plus, de 150 cas de brucellose depuis janvier. [Электронный ресурс]. URL: <https://www.algerie360.com/Tiaret-plus-de-150-cas-de-brucellose-depuis-janvier/> (дата обращения 05.02.2020).
- 17 The Centers for Disease Control and Prevention. Risks from Unpasteurized Dairy Products. [Электронный ресурс]. URL: <https://www.cdc.gov/brucellosis/exposure/drug-resistant-brucellosis-linked-raw-milk.html> (дата обращения 03.02.2020).
- 18 Brutsellez. 2020. <https://www.who.int/ru/news-room/fact-sheets/detail/brucellosis>
- 19 V Kazahstane umenşilos kolichestvo ochagov brutselleza. 2023. https://forbes.kz/news/2023/07/03/newsid_304371
- 20 Grozit li Kazahstanu epidemiya brutselleza. 2023. <https://dairynews.today/kz/news/grozit-li-kazahstanu-epidemiya-brutselleza.html>

21 Syrym, N. S. Reasons behind the epidemiological situation of brucellosis in the Republic of Kazakhstan, [Text] /Acta Tropica, Vol. 191, p. 98-107 (<https://www.sciencedirect.com/science/article/abs/pii/S0001706X18312270>)

22 Shevtsov, A. Brucella abortus in Kazakhstan, population structure and comparison with worldwide genetic diversity, [Text] /Frontiers in Microbiology, Vol. 14, 1106994 (<https://www.frontiersin.org/articles/10.3389/fmicb.2023.1106994/full>)

23 Abutalip, A. [Text] /Phenotypic and Genotypic Characteristics of Brucella Strains Isolated from Animals on the Territory of the Republic of Kazakhstan // International Journal of Veterinary Science. - 2024.-P.1-7. (65 процентиль). <https://doi.org/10.47278/journal.ijvs/2024.223>

ТҮЙІН

Бруцеллез – дүние жүзіндегі ауылшаруашылық және жабайы жануарлардың кең тараған зооноздық жұқпалы ауруларының бірі, жануарлармен немесе жануарлардан алынатын өнімдермен жанасқанда адамға жұғуы мүмкін. Әсіресе Қазақстан Республикасы сияқты мал шаруашылығы қарқынды дамыған аймақтарда. Бұл ауру мал өнімділігін айтарлықтай төмендетеді, сол арқылы ел экономикасына зиян келтіреді. Қазақстан эндемиялық ел болып табылады, ауру жануарлар мен адамдарда жыл сайын тіркеледі. Бруцеллездің қоздырғышы В категориясына жатқызылған ықтимал биологиялық соғыс агенті болып табылады.

Мақалада 2019-2023 жылдардағы БҚО-дағы жануарлар бруцеллезінің эпизоотиялық жағдайын зерттеу бойынша зерттеулердің нәтижелері келтірілген. ҚР-дағы бруцеллез эпизоотологиясындағы ІҚМ мен ұсақ малдың басым рөлі анықталды, облыс аудандарында бруцеллездің барлық жерде дерлік таралуы атап өтілді, жануарлардың бруцеллезі бойынша қолайсыздықтың туындауына және сақталуына ықпал ететін аса маңызды себептер айқындалды. Эпизоотологиялық мониторинг нәтижелері бойынша жануарлардың бруцеллезбен залалдану дәрежесі бойынша БҚО аудандарының аумақтарын әртүрлі санаттарға (жоғары, орта, төмен дәрежелі және қолайлы аймақтар) аймақтарға бөлудің эпизоотиялық картасы жасалды, онда тиісті сараланған эпизоотияға қарсы іс-шаралар жүргізілетін болады.

РЕЗЮМЕ

Бруцеллез является одним из наиболее распространённых зоонозных инфекционных заболеваний сельскохозяйственных и диких животных в мире, способного заразить человека через контакт с животными или продукты животного происхождения. особенно в регионах с интенсивно развитым животноводством, каким является Республика Казахстана. Это заболевание значительно снижает продуктивность скота, тем самым нанося ущерб экономике страны. Казахстан является эндемичной страной, в которой ежегодно регистрируется случаи заболевания животных и людей. Возбудитель бруцеллеза является потенциальным боевым биологическим агентом, отнесенным к категории Б.

В статье приводятся результаты исследований по изучению эпизоотической ситуации бруцеллеза животных в ЗКО за 2019-2023 гг. Установлена главенствующая роль КРС и МРС в эпизоотологии бруцеллеза в ЗКО, отмечено почти повсеместное распространение бруцеллёза в районах области, определены наиболее значимые причины, способствующие возникновению и сохранению неблагополучия по бруцеллезу животных. По результатам эпизоотологического мониторинга составлена эпизоотическая карта зонирования территорий районов ЗКО по степени заболеваемости животных бруцеллезом на различные категории (с высокой, средней, низкой степенью и благополучные зоны), в которых будут проводиться соответствующие дифференцированные противоэпизоотические мероприятия.