



Risk Factors of Stationarity of Brucellosis Among Animals and Humans

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Abstract

Background: Brucellosis is an infectious bacterial disease with significant epizootic and epidemiological impact, affecting both animals and humans. The disease is particularly prevalent in regions with extensive livestock farming, leading to considerable economic and social harm. The persistence of brucellosis in certain areas, despite preventive measures, necessitates further investigation into the risk factors contributing to its stationarity. **Objective:** The study aims to identify and analyze the risk factors contributing to the stationary presence of brucellosis among animals and humans in the Zhany-Zher village, Sokuluk district, Kyrgyz Republic, over a six-year period. **Methodology:** Epizootological studies were conducted on the incidence of brucellosis in animals and humans on a farm in Zhany-Zher over six years (2018-2023). Data were collected from serological studies of blood from cows and milk samples. The study also included a survey of private farms and analysis of veterinary and economic activities. The results were presented in both tabular and graphical formats. **Results:** The analysis of serological studies indicated that brucellosis was detected annually among cows in Zhany-Zher, with the percentage of positive cases ranging from 2.17% to 12.02%. The highest rate of positive cases was observed in 2022, attributed to reduced diagnostic efforts during the COVID-19 pandemic. Brucellosis was also detected in other animals, including dogs, and human cases were reported annually. **Conclusion:** The stationary nature of brucellosis in Zhany-Zher is maintained by various risk factors, including uncontrolled movement of livestock, inadequate serological examination of fattening bulls, and the presence of pets that may act as carriers of the disease. Effective management requires strict monitoring of livestock transactions, regular diagnostic testing, and public education on brucellosis. [Bangladesh Journal of Infectious Diseases, June 2024;11(1):38-44]

Keywords: Brucellosis; epizootology; epidemiology; susceptible animals; risk factors

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Introduction

Brucellosis is an infectious bacterial disease of an epizootic and epidemiological nature¹. It mostly affects animals (cattle, pigs, goats, sheep, dogs, etc.), from which people become infected². Thus, brucellosis is one of the overt zoonoses^{3,4}. According to the World Health Organization (WHO) data, brucellosis among animals is registered in 155 countries of the world (data from 1986)⁵. This disease is widespread among people all over the world and the greatest danger to humans is *Brucella melitensis*⁶⁻⁸.

This disease causes great economic and social damage¹⁰ since the incidence of this infection is accompanied by damage to the musculoskeletal system, cardiovascular, nervous, and other systems in people. It also causes forced slaughter of sick animals^{11,12,13}. For European countries, brucellosis is a priority disease¹⁴ and it is noted that the disease is widespread not only in countries with an endemic nature of the disease but also in countries considered safe¹⁵.

The epizootic and epidemiological situation of brucellosis in the world and Russia in 2011 to 2020 has been reported by Ponomarenko et al⁸, who call this situation "unfavorable with dynamics aimed at reducing human morbidity against the background of persistent epizootological problems among cattle and small farm animals". Ponomarenko et al⁸ note that in some regions, there is a risk of widespread brucellosis among farm animals. From this, it can be concluded that with an increase in the incidence of diseases among animals, the risk of human infection from them also increases.

There are reports of brucellosis endemicity among animals in the countries of Central Asia and the South Caucasus, where the highest rates of human brucellosis are observed¹⁵. However, it should also be considered that the real prevalence of brucellosis is higher than the official reported data^{17,18,19}. Lyamkin et al¹⁶ note the variety of risk factors for the disease of livestock breeders, veterinary workers, and workers of the meat processing industry with brucellosis in the Omsk region of the Russian Federation, namely biological, epidemiological, sanitary, hygienic and risks.

In Central Asia, as noted by Pylaev and Bikmurzin²⁰, Kazakhstan ranks second after Kyrgyzstan in the post-Soviet space in terms of the incidence of human brucellosis. As some researchers note⁶,

this incidence, although moderate, increases, and, importantly, children also get sick (up to 10% of the total incidence of brucellosis). In general, the disease is most often registered in people aged 39 years and older (61.1%).

Analyzing the risk factors and the analogy of the mechanism of brucellosis transmission among the population in Tajikistan, Kyrgyzstan, and Uzbekistan, researchers Nurpeisova et al.²¹ conclude that the dominant role of the contact mechanism of brucellosis infection is associated with the similarity of cultural, national, and behavioral traditions among the peoples of these states. Abdikarimov et al²² in a study to identify risk factors for human brucellosis in the Ak-Talaa district, Naryn region, Kyrgyzstan, showed that the leading factors of human infection with brucellosis were animal delivery, stall cleaning, and keeping livestock in the household, in particular sheep.

As can be seen from literary sources, brucellosis is registered in many countries, including Kyrgyzstan, and this problem is epizootic and epidemiological, has a high priority, and is endemic, which leads to its stationary manifestation^{23,24}. It is also characteristic of this disease that the actual prevalence of brucellosis in disadvantaged regions is higher than official data. Risk factors, as many researchers believe, are diverse and have a biological, epidemiological, sanitary, and hygienic nature. This leads to the fact that the elimination of brucellosis remains an extremely difficult problem to solve¹⁵.

This present study was undertaken to conduct epizootic and epidemiological studies to establish the stationary nature of brucellosis incidence in animals and people in the Zhany-Zher village, Sokuluk district, Kyrgyzstan and to identify risk factors for the disease of animals and people at this farm.

Methodology

Study Settings and Population: This was an Epizootological study.

Study Materials: The material for the study was the results of blood serum studies by the serological department of the Republican Veterinary Diagnostics Center (PTsVD) and a study of the cow milk produced in Zhany-Zher by the Osh Market Veterinary and Sanitary Expertise (VSE) laboratory; the results of a survey of private farms; and the results of the collection of current and retrospective anamnesis data.

Study Procedure: Epizootological studies were carried out according to the methods accepted in epizootology. We studied the geographical, economic, and veterinary conditions in Zhany-Zher. We examined the livestock farms and collected anamnesis data on veterinary and economic activities, keeping and feeding of animals, the spread of brucellosis among animals and humans, and reporting data and results of diagnostic studies on cows for six years (2018-2023). The data obtained was analyzed and described in a table and a graph.

Statistical Analysis: The collected data were analyzed using descriptive statistics to determine the frequency and percentage of brucellosis cases detected among the animal population over the six-year period.

Ethical Clearance: The study was conducted in accordance with the ethical standards of the Kyrgyz Republic. All procedures involving human participants were carried out following the principles outlined in the Declaration of Helsinki and the ethical guidelines provided by the World Health Organization (WHO).

Results

When studying the annual reports of the VSE laboratories of the Bishkek markets, we found that during the study of milk coming for sale, milk samples that responded positively to brucellosis were detected annually, as a result of which the milk was disposed of¹⁶. This is a potential danger of human infection with brucellosis through animal products.

We researched the epizootic and epidemiological situation concerning brucellosis in Zhany-Zher

and identified factors contributing to its stationary manifestation. According to veterinary specialists, this farm had been permanently dysfunctional for 6 years (the time of the chief veterinarian's activity), and according to anamnesis data it had been dysfunctional before.

It is located in the northwestern part of the Chui Valley. The farm is mainly engaged in raising livestock and producing crops. Animal husbandry is represented by animals in private farms and two private mini cattle farms. In total, the village has 7 thousand heads of cattle, including 1,200 cows, 5,000 bulls, and 800 calves and 3,200 head of cattle for the survey period. Other animal species include horses, pigs, dogs, cats, and poultry.

The Zhany-Zher farm is part of the village district, which includes five villages. The animals of these settlements are managed by three veterinarians. For brucellosis, cows and bulls used for artificial insemination are examined serologically twice a year. Fattening bulls are not examined, as they are fattened up to 1.5 years old and put to slaughter. Small cattle are vaccinated twice a year with the Rev-1 vaccine using the intraocular method. The research results for six years (2018-2023) are presented in Table 1.

It can be seen from Table 1 that serological studies of cattle on this farm annually showed inconclusive or positive reactions to brucellosis. The percentage of animals responding positively was low (from 2.17 to 12.02%). The highest value (12.02%) was recorded in 2022. This is due to the fact that in 2021, during the pandemic, few diagnostic studies were conducted, as a result of which sick animals were not identified and stayed in the herd. This is clearly shown in Figure 1.

Table 1: Blood testing from cows of the Zhany-Zher farm for brucellosis

Year	Total Studied	Complement fixation test (CFT) results			
		Negative, Heads	Inconclusive, Heads	Positive	
				Heads	Percent
2018	431	410	8	10	2.32
2019	600	567	15	13	2.17
2020	112	103	3	6	5.36
2021	51	51	-	-	-
2022	491	416	14	59	12.02
2023	364	326	9	28	7.69

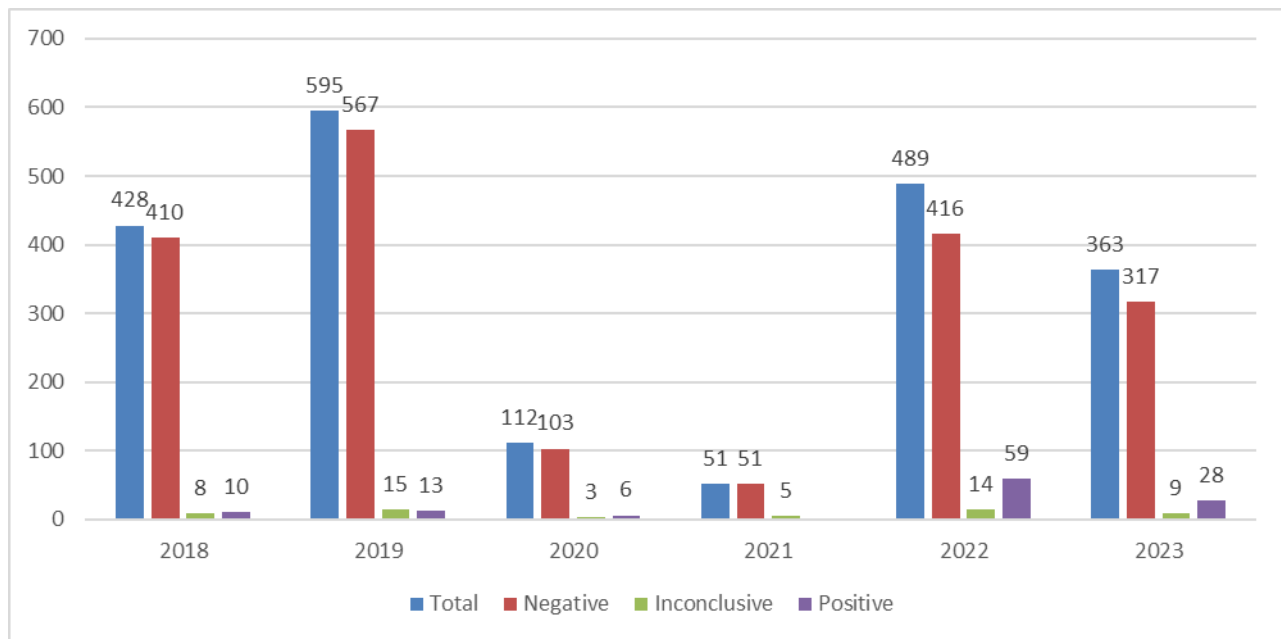


Figure I: Graph of the results of serological studies of animals for brucellosis in Zhany-Zher

The animals that reacted positively were sent to slaughter in a slaughterhouse, and cows with inconclusive results were further tested and treated according to the rules for brucellosis control. During our survey in Zhany-Zher, we studied the situation in two private farms. The first private farm (Bobok) had 11 dairy cows, seven calves, five heifers, and a stud bull. In addition, there were 80 sheep and a dog with a puppy. The second farm was the Kuttubek Degenbayev dairy farm, which had 45 cows, 20 calves, and 12 cows in the dry period. Both farms are small. There are no farms with more than 100 heads in this area at all. In general, the area is dysfunctional, 1,000-1,200 blood samples are checked during the season, and 6-10% of positive cases are detected.

In 2022, at the Kuttubek Degenbayeva farm, two cows tested positive for brucellosis during a blood test. The owner of this farm doubted that the result was correct since the conditions for the animals were good and there was no contact with other farms. The cows grazed on a separate territory adjacent to this farm. However, 5 years prior, one cow on this farm had already tested positive. To confirm the current result, they conducted the study again. Before the re-examination, they isolated the positive cows and kept them separate from the rest. Unfortunately, the positive result was confirmed in June, and in the spring of this year (2023), 19 more cows reacted positive to brucellosis.

In addition to the serological blood test (CFT), we also conducted a household study of milk from cows from private farms. Thus, in October 2023, a

serological blood test was conducted on 181 cows. 23 (12.7%) cows reacted positive, and 2 (1.1%) cows returned inconclusive results. In November, milk from the cows was examined, which gave a positive reaction in a blood test. Of the 11 milk samples studied (four samples were rejected), six cows gave a positive result in the ring test with milk and one gave an inconclusive result (Figures 2 and 3). According to the results of these studies, the detectability of cows with brucellosis in the milk test is about 50% compared to that indicator in the blood test. Pets also underwent tests. Dogs were tested for brucellosis during their antiparasitic treatment against echinococcosis. One dog showed a positive result, but veterinary specialists of the farm believed that the dogs got infected by the cows and not vice versa. However, no special studies were conducted to confirm this conclusion. In this farm, cases of human brucellosis were been detected, which indicates the social significance of brucellosis there.

Veterinary specialists do everything possible to prevent the spread of brucellosis. The farm conducts serological studies on brucellosis in animals (cows; bulls used for artificial insemination; dogs) for timely diagnosis. Preventive and forced disinfection is carried out with bleach, and rat extermination is performed with Neocidol. Young farm animals are vaccinated against brucellosis. Feeding is carried out with the feed produced by the farm, that is, the possibility of infection with brucellosis with feed from other farms is excluded.



Figure II: A positive result in a ring test with milk

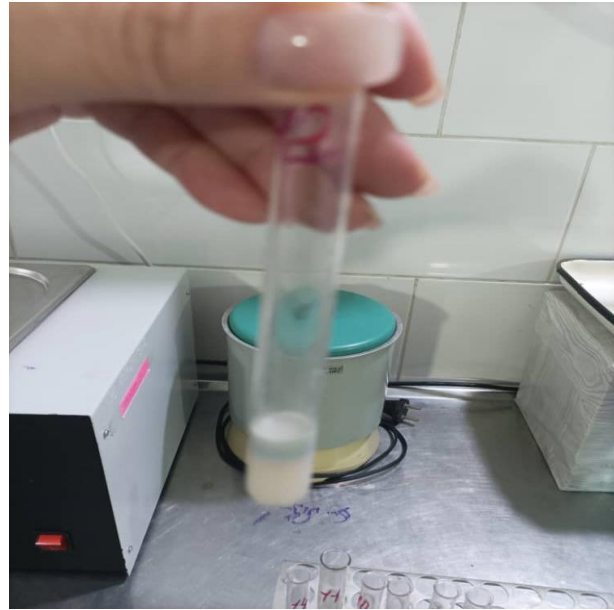


Figure III: A negative result in a ring test with milk

There is no contact with animals from other farms at pastures. However, as follows from the anamnesis data, there are cases when animal owners sell or buy animals at markets without veterinary certificates.

As follows from the above data, the Zhany-Zher farm is permanently dysfunctional due to brucellosis. To improve its situation, it is necessary to know the risk factors for maintaining stationary brucellosis on this farm and possible ways to eliminate those factors. The chief veterinarian of this farm believes that to eliminate brucellosis in their farm, it is necessary to vaccinate cattle with a vaccine from strain 19. Zoonoses are of great importance both in epizootology and epidemiology. Such diseases include brucellosis, which, according to the literature, is widespread and of priority importance among other zoonoses^{1, 7}. It acquires special importance when it becomes endemic and has a stationary nature, since in this case "the real prevalence of brucellosis is higher than the official data"^{4, 9}. Brucellosis is more often registered in regions with developed animal husbandry, and the incidence in people increases with an increase in livestock farms that are infected with brucellosis².

Discussion

To prevent people from contracting zoonotic infectious diseases, it is necessary to identify cause-and-effect models of the epizootic and epidemiological situation of the infectious disease under study, in this case, brucellosis, and identify risk factors. This makes it possible to develop

effective systems of both antiepidemiological and antiepidemiological measures.

Kyrgyzstan has a high incidence of brucellosis, and as follows from literary sources, among the Eastern Europe and Central Asia (EECA) countries, it ranks first in the incidence of brucellosis in people^{4,10,11}. We set the task of studying the epizootic and epidemiological situation of brucellosis stationarity among animals and humans in one of the farms with brucellosis in the Chui region. Anamnesis studies found that other farms included in this rural district are also affected by brucellosis and were affected even before 2018.

As a result of the conducted epizootological studies, we found that Zhany-Zher had been affected by brucellosis for the last six years (2018 to 2023), which was confirmed by the results of serological studies. All cows and bulls used for natural insemination are regularly serologically examined for brucellosis twice a year, except for bulls raised for meat. As can be seen from Table 1, cases of brucellosis are detected annually, but their percentage in the total population is low. We believe that this is because veterinary specialists constantly carry out measures aimed at identifying and eliminating this infection, as well as a set of anti-epizootological measures.

The importance of these measures is evidenced by the fact that when diagnostic tests were reduced during the pandemic, as a result of which sick animals were not identified and removed from the herd, and the percentage of animals tested

positively increased dramatically the next year (2022).

Conclusions

Analyzing the results of the epizootological situation regarding the stationarity of brucellosis in Zhany-Zher, we found that brucellosis at this farm had been stationary for a long time. Other farms in this rural district are also dysfunctional. Brucellosis is detected in different types of animals (cattle and pets) and has social significance since people also get sick. The regularity of diagnostic and anti-epidemic measures is of great importance. Based on the conducted study, the following risk factors were identified. The purchase and sale of animals by humans bypassing the control of veterinary specialists. This sales traffic is intense. Fattening bulls can be a risk factor since they are fattened in conditions of a dysfunctional brucellosis farm. Sour cream may be one of the risk factors for human infection with brucellosis. Pets (cats, dogs) may be among the *Brucella* carriers. Considering recommendations, it is necessary to strictly monitor newly acquired animals of the private sector, up to their placement in preventive quarantine in doubtful cases. Farms should carry out a diagnostic study of bulls that are fattened. The authorities should carry out educational work on brucellosis among the population.

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Conflict of Interest

No competing interests exist by the authors.

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Contribution to authors:

Rasida Karabaeva, Lydia Maygulakova: Conception and design, or design of the research. Rasida Karabaeva, Eliza Asanova: The acquisition, analysis, or interpretation of data; conceptualized and designed the overall study. Akram Madumarov, Anarbek Uulu Sovetbek: Involved in data collection; Rasida Karabaeva, Anarbek Uulu Sovetbek: Drafting the manuscript or revising it critically for important intellectual content. Eliza Asanova, Akram Madumarov: Involved in data input and data cleaning. Lydia Maygulakova, Eliza Asanova: Conducted data analysis. Anarbek Uulu Sovetbek, Lydia Maygulakova: Drafted the manuscript. All authors reviewed and approved the final manuscript

Data Availability

Any questions regarding the availability of the study's supporting data should be addressed to the corresponding author, who can provide it upon justifiable request.

Ethics Approval and Consent to Participate

This study was approved by the Kyrgyz National Agrarian University named after K. I. Skryabin. All participants were

informed about the study and they gave their written consent before inclusion in the study.

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