

## Cattle Brucellosis: Epizootiology, Diagnosis, Prevention and Control Measures in Kazakhstan

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**Abstract:** The paper presents the epidemic and epizootic situation on cattle brucellosis in the Republic of Kazakhstan, the description of the situation of animals brucellosis in Kostanay region. Nowadays *Brucella* genus includes 10 species, many of which are pathogenic for humans. Here is given comparative results of the diagnostic value of classical and modern methods of brucellosis diagnosis, development and implementation of preventive measures for cattle brucellosis without using of antibrucellar vaccines and determination of economic efficiency of health (in sorting out of reactive) and preventive measures.

**Key words:** Brucellosis • Diagnosis • Prevention • Epizootic situation • Economic loss • Immunity • Vaccine

### INTRODUCTION

The problem of brucellosis eliminating, unfortunately, presents considerable difficulties due to its wide distribution in many countries of the world, i.e., the ability of causative agents habitations in organisms of various species of living beings, as well as in a significant number of cases of latent clinical course of the disease and difficulties of diagnosis and specific prevention associated with this process. This disease is very dangerous for people, which often leads to disability and sometimes to permanent disability [1, 2].

*Brucella* genus merges nine different species: *Br. melitensis*, *Br. abortus*, *Br. suis*, *Br. canis*, *Br. neotomae*, *Br. ovis*, *Br. ceti* (the causative agent of cetaceans brucellosis), *Br. pinnipedialis* (the causative agent of pinnipeds brucellosis) and *Br. microti* (the causative agent of gray voles brucellosis) [3, 4]. Nowadays *Brucella* genus includes more than 10 species of *Brucella* [5-7]. Many of them are pathogenic for humans. The first three species of *Brucella* according to a number of distinctive features are divided into biotypes: *Br. melitensis* -3, *Br. abortus* -8, *Br. suis* -5 [2].

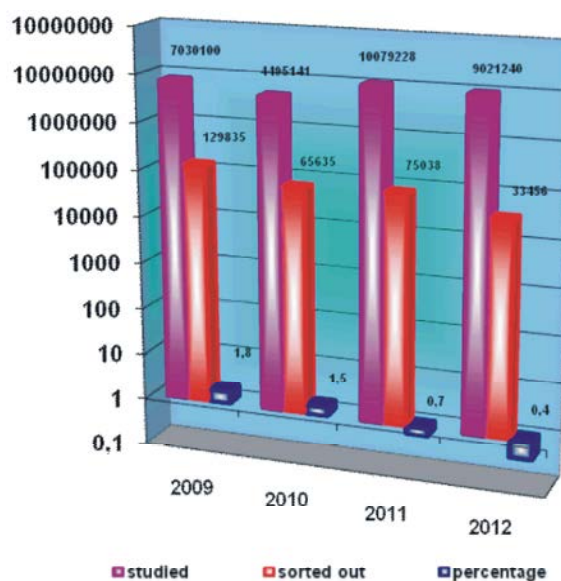


Fig. 1: The number of studied responsive animals for the period of 2009-2012.

**Materials and methods.** The official veterinary report data for the period of 2009-2012 in the Republic of Kazakhstan reflects the alarming epizootic situation on cattle brucellosis (Figure 1).

Table 1: Epizootic situation of Kostanay region enterprises on cattle brucellosis for the period of 1997-2012

Years	Total number of	The number of	Percentage of infection	Sent to
1997	354,92	5,6	1,57	5,6
1998	301,95	3,06	1,0	3,06
1999	240,86	1,84	0,7	1,84
2000	258,56	1,64	0,6	1,64
2001	400,58	1,87	0,46	1,87
2002	406,93	2,25	0,55	2,25
2003	485,7	1,8	0,4	1,8
2004	565,63	2,27	0,4	2,27
2005	567,1	1,53	0,27	1,53
2006	574,41	1,2	0,21	1,2
2007	740,0	1,33	0,18	1,33
2008	479,95	5,17	1,08	5,17
2009	629,83	12,21	1,94	12,21
2010	558,66	7,75	1,39	7,75
2011	823,55	5,25	0,64	5,25
2012	975,46	4,51	0,46	4,51
Total	8364,11	59,28	0,74	59,28

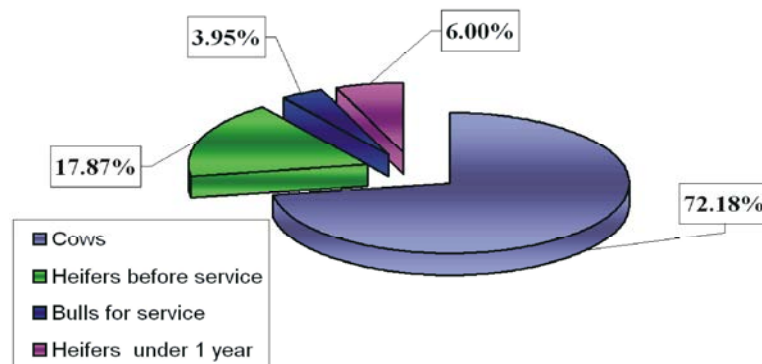


Fig. 2: Structure of the cattle responsive to brucellosis of Kostanay region for the period of 2009-2012.

It follows from the analysis of indexes that then umber of responsive animal sis ranging from 33.5(2012) to 129.8(2009) thousand heads and the percentage of infection is from 0.4 to 1.8%. One of the features of territorial epizootiology of cattle brucellosis is an even expressed infection of this kind of cattle (from 0.1 to 6.5%).

Epizootic situation of agricultural enterprises of Kostanay region on cattle brucellosis is for the period of 1997-2012 year's is shown in the Table 1.

From the indexes in Table 1 it follows that the intensity of the epizootic process of cattle brucellosis for the period of 1997-2012 has some what stabilized. The number of responsive animals in 2007 comparing with the same index in 1997 decreased 4, 2 times and the percentage of infection decreased more than 8, 7 times. In 2008, the percentage of cattle infected with

brucellosis increased 6 times and amounted to 1.08, in 2009 - 10, 8 and 1, 94 respectively. The number of animals responsive to brucellosis this year has risen to 12,200 heads, which is 9.17 and 2.36 times more than in 2007 and 2008. Comparatively high rate of cattle responsive on brucellosis was registered in 2010. During the following 2011-2012, number of responsive cattle decreased by 1.4-1.7 times and the percentage of infection decreased by 2, 2-3, 0 times and became 0.46% in 2012.

All the animals responsive to brucellosis were slaughtered and the derivative products were processed at restricted access facilities.

Information on the cattle of different age groups of Kostanay region enterprises which is responsive to brucellosis for the period of 2009-2012 is resented in Figure 2.

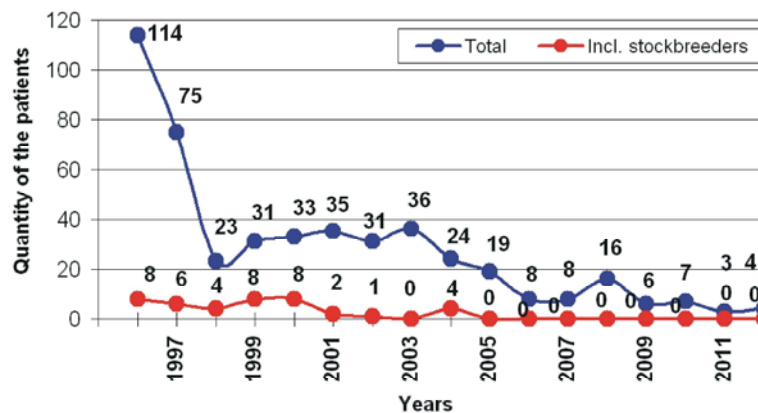


Fig. 3: Incidence of human brucellosis in Kostanay region for the period of 1996-2012 (newly diagnosed cases)

The analysis of indexes in Figure 2 shows that out of then umber of analyzed cattle responsive to brucellosis for the period of 2009-2012 where total number is more than 29, 300 heads: 72.18% are cows, 17.87% are heifers before service, 6.0% -young heifers under 1 year and 3.95% -bulls for service.

In the structure of the small cattle responsive positively to brucellosis according to serology (total number is than 3,900 heads) for the period of 2009-2012 - 91.18% are ewes, 5.04% - stud ram sand 3.78% - 3 young hogs - 5 months.

Other types of farm and domestic animals also were registered as responsive to brucellosis according serology. Therefore in 2012, total number of tested horses was more than 12.0 million, 10 or 0.08% out of them were sorted out. The respective figures were registered among camels - 556, 8 and 1.44; among pigs - 12, 0 thousand, 3 and 0.02, among carnivores - 410, 2 and 0.49.

In 2011, 88% of the animals responsive to brucellosis were reported in the rural districts with the infection percentage from 0.1 to 10%. Share of brucellosis-free rural districts was 12%. In 2012, the percentage of brucellosis-free rural districts increased almost 2.4 times which is 28.68%. Number of responsive animals with the infection percentage from 0.1 to 1% comes to 53.49%, the animals with percentage from 1.1 to 3% are 12.41% and the other animals with percentage from 3.1 to 6% are 4.26% respectively. Within three rural districts which is 1.16%; infection rate was more than 6.0%. The same situation was evidenced practically in all rural districts and it requires taking the set of immediate and rapid preventive health anti-brucellosis measures.

All the horses, camels and pigs responsive to brucellosis were killed at restricted access facilities and small cattle and carnivores were incinerated.

Registered epidemic rates also confirmed the problem of animal brucellosis in the regions of the Republic of Kazakhstan. The most intense epizootic situation on the brucellosis of sheep and goats is being evidenced in the Southern and Eastern regions of the country. They account for over 93% of disadvantaged areas and from 75.6 to 85.5% of the fresh cases when people when people get infected with brucellosis (newly diagnosed cases) [8].

Regardless of the infection source from brucellosis human, hemoculture of *Br. melitensis* was isolated.

Information on the incidence of human brucellosis in Kostanay region for the period of 1996-2012 is shown in Figure 3.

From the analysis of indexes in Figure 3 it follows that the quantity of fresh brucellosis cases tends to a sharp decline. In recent years the number of cases varies from 3 to 7 people per year and the quantity of stockbreeders (2009-2012) reduced to zero.

Application of ELISA in diagnosis of cattle brucellosis dramatically increased the quantity of the responsive animals, primarily among cows. Concerns about the situation and the great number of the animal responsive to brucellosis caused us to conduct a commission and comparative study using ELISA and classical serological methods (rose bengal probe-RBP, agglutination assay-AA, complement fixation assay-CFA and prolonged complement fixation test-PCFT).

To this end, in three disadvantaged brucellosis farms, 50 heads were sorted out of cows which showed primed reaction to ELISA and then they were studied using the comprehensive diagnostic tests with application of classical and modern methods. Research was carried out individually for each head; fresh cases of sorting out were studied at first and then repeatedly, after 40-70 days after overexposure. A comparative analysis revealed that out

of 100% of primary responsive animals tested by ELISA, from 22 to 38% animals had classical reactions. Re-analysis showed: the quantity of reactions of the same animals increased by 30% according to RBP (from 38 to 68%), according to AA 32% (from 28 to 60%) and according to CFA-by 36% (from 22 to 58%) and according to PCFT by 64% (from 20 to 84%).

At the end of the experiments, all 50 cows were exposed for a commission-monitoring slaughter. The samples of biological material (parenchymal organs, lymph nodes, blood) were selected for bacteriological, biological and molecular genetic studies. Conducted bacteriological research confirmed the results of serological tests using ELISA in 58% (range from 53.3 to 60%), biological studies-60% and molecular-genetic studies confirmed the results in 62% (range from 60 to 70%) of cases [9-11].

Comparative cost-effectiveness of necessary sanitary measures used for sorting out the cows responsive to brucellosis as well as cost-effectiveness of preventive measures for brucellosis cattle has shown that carrying out necessary sanitary measures for sorting out and forced slaughter of individual cows responsive to ELISA are economically justified. Cost-efficiency in seven rural districts is 1,415.14 million tenge and efficiency on the cost of 1 tenge is 15.26 tenge.

Cost-efficiency of the preventive measures is 1,472.98 thousand tenge and efficiency on the costs of 1 tenge is almost 20 tenge.

According to the total index, prophylaxis is 1.3 times more efficient than necessary health measures (19, 92:15, 26).

In Kazakhstan, preventive measures and sanitation of cattle from brucellosis were carried out without the specific preventive measures over the past seven years (2007-2013). The ban on vaccination of cattle, lack of brucellosis treatment transformed the prophylaxis of this disease into the administrative, organizational and economic, sanitary measures. In this regard, we have developed and tested a system of preventive measures for brucellosis cattle without antibrucellar vaccines. The essence of the system is that in addition to the all-round protection of agricultural enterprises from brucellosis agents in their causative agents of brucellosis, the double disinfection is carried out (in spring after running the cattle for summer pasture and in autumn before the cattle stabling). In the same period, the animals were injected with ivomek or another effective anti-parasite medication (according to the instruction), which contributed to a sharp decline in the exo-and endoparasite (especially nematodes) almost for the entire year. During the tests for determining of infested animals in experimental and control groups prior to the experiments conducted using the coprological examination it was found that they were infected with helminths of the genus trichostrongylidae by 40-87%. Two weeks after worming experimental animals were infested by 4.8% (5 of 104 animals). At the same time,

Table 2: Information on the serology and sorting out of the cattle responsive to brucellosis for the period of 2009-2012 in rural districts of Taranovskiy region

												Novo-		
No	Rural districts	Asenkritovskiy	Belinskiy	Evgenovskiy	Kayrankolskiy	Kalinskiy	Kolosovskiy	Krasnoselskiy	Mayskiy	Naberezhnenskiy	Nelyubinskiy	Ilinovskiy	Pavlovskiy	
2009 Studied number														
	of animals	Primary	4106	552	542	876	4625	1023	1103	370	677	307	2446	3162
	(heads)	Secondary	3594	448	458	824	3375	977	897	130	323	293	1554	2838
Sorting out of the responsive animals			129			121	6		1		2		2	34
(heads)														
% of infected			3,1			13,8	0,13		0,09		0,3		0,08	1,08
2010 Studied,														
Total (thous. heads)			6,0	1,2	1,2	1,6	7,0	1,7	1,8	0,5	1,2	0,8	4,0	4,6
Sorting out of the responsive animals (heads)			6			43	2	4	4		1			3
% of infected			0,1			2,69	0,02	0,24	0,22		0,08			0,07
2011 Studied, Total														
(thous. heads)			7,9	2,0	1,8	2,4	11,2	2,3	2,8	1,3	1,8	1,8	4,7	4,5
Sorting out of the responsive animals (heads)			2			5	6	1		6		1		1
% of infected			0,02			0,2	0,05	0,04		0,46		0,05		0,02
2012 Studied, Total														
(thous. heads)			3760	1750	803	1695	6500	1400	1613	641	1564	1100	3446	2150
Sorting out of the responsive animals (heads)			2	-	-	6	-	-	3	-	-	6	3	2
% of infected			0,05	-	-	0,35	-	-	0,19	-	-	0,55	0,09	0,09

the animals from control group were infested by 37.78% (42 of 112 animals). A month later planned serological testing was conducted sequentially for determining the brucellosis and other infectious diseases, as well as routine immunization. The proposed system does not contradict with the general rules, the requirements of the regulations and guidelines for all nosological diseases, which are described in Veterinary legislation of the Republic of Kazakhstan and involves these quence changes in the planned animal epidemic countermeasures aimed to create optimal conditions for maximizing the immune abilities of the animals' bodies.

## RESULTS

Implementation of preventive measures system for cattle brucellosis for the period of 2010-2012 (Table 2) showed the following results:

During 2009-2010, prior to the implementation of preventive measures in the region farms, 328 and 68 animals were sorted out as responsive to brucellosis.

In 2011, total number of cattle kept at the farms of Taranovskiy region is 19, 4 thousand, out of them 55.0 thousand heads were selected for serological tests on brucellosis determining. Multiplicity of research in the region was more than 2.8 times. In seven rural districts, out of total number of studies animals, 22 cows responded according to ELISA.

In 2012, in nine rural districts, 33.2 thousand of cattle passed through serologic tests, 34 responsive animals were sorted out, which was 0.1%, including 30 responsive heads out of 24.3 thousand studied (0.12% ) in the private sector and only 4 responsive animals out of 8.96 thousand (0.04%) kept by LLP enterprises. Responsive animals were sent to the restricted access facilities.

## CONCLUSIONS

- Epizootic situation on cattle brucellosis in the Republic of Kazakhstan, as well as in agricultural enterprises of Kostanay region continues to be challenging and stressful and does not provide a favorable prognosis in the near future if the set of antibrucellar measures is not improved.
- In 2012, analysis of 260 rural districts involved into cattle breeding, showed that more than 70.16% of them are registered as responsive to brucellosis determined by ELISA with the percentage of infected animals from 0.1 to 6.0% and only 1.16% showed the infection rate of more than 6.0%. Share of brucellosis-free rural districts accounted for 28.68%.

- ELISA for the serological diagnosis of cattle brucellosis reveals by 2.0-3.5 times more responsive animals at an earlier stage in comparison with conventional classical methods. The accuracy of the ELISA diagnosis confirmed by bacteriological, biological and molecular genetic studies.
- Implementation of preventive antibrucellar measures without antibrucellar vaccines in veterinary practice allowed to reduce the number of animals responsive to brucellosis by 2,0-3,09 times.
- Timely and prompt implementation of preventive and necessary sanitary antibrucellar measures are economically justified, such measures include slaughter of individual cows responsive to ELISA, as they being identified. Cost-effectiveness for this group of rural districts accounted for more than 1415.0 thousand tenge and efficiency on the cost of 1 tenge is more than 15 tenge.

Preventive measures produced the efficiency in the amount of nearly 1473.0 thousand tenge and efficiency on the cost of 1 tenge about 20 tenge or 1.3 times more.

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