ISSN: 0975-8585

Research Journal of Pharmaceutical, Biological and Chemical Sciences

Risk assessment of foot-and-mouth disease emergency in different regions of the Republic of Kazakhstan.

Abdrakhman Baygazanov[1]*, Yerken Kassymov[2], Tatyana Bleim[1], Maral Nurkenova[1], Kamil Derbyshev[1], Esengeldy Omarbekov[1], and Aleksandra Tleubayeva[1].

[1]Shakarim State University of Semey, Glinki street, 20A, Semey 071412, Kazakhstan.
[2]Kazakh National Agrarian University, Abai Ave. 8, Almaty, 050010, Kazakhstan.

ABSTRACT

This article shows the results of research of foot-and-mouth disease in different regions of the Republic of Kazakhstan through discovering antibodies to nonstructural protein of serum virus of the cattle with the help of the test-system CHEKITFMD 3ABCbo-ov. It was established that discovery of antibodies against nonstructural protein virus of foot-and-mouth disease allows to determine not only presence of virus carrier the farm but also to determine a sanitary status of the animals imported from other countries. Vaccination in the Republic of Kazakhstan as a measure of forced specific preventive measures must be held by "classical" inactive against foot-and-mouth vaccine of high cleaning from all nonstructural proteins as none of regions can consider itself protected from the risk of infection emergency inside and out.

Keywords: Foot –and- mouth diseases, East-Kazakhstan, zone, CHEKITFMD 3ABCbo-ov

Corresponding author

ISSN: 0975-8585

INTRODUCTION

In case of discovery of antibodies, against foot-and-mouth diseases, it is extremely important to differentiate the antibodies which have emerged as a result of vaccination and those which have appeared due to infection. In order to solve this problem the antibodies of structural and nonstructural protein of foot-and-mouth virus appear. Structural proteins are those which are formed by the virus for formation of its own structure (protein capsid). Nonstructural proteins are those which are produced during the virus multiplication. They are necessary for transcription, multiplication of RNA and for formation of capsid. Thereon antibodies are produced against many of them [1, 2, 3].

The foot-and-mouth virus belongs to Aphtoviridae, which divide into seven serotypes (O, A, C, Asia 1, SAT1, SAT2, SAT3) and several sub-types, taking into account essential variety of three dimensional structure. The nonstructural proteins have a small variety and are practically same in all types of foot-and-mouth diseases. Advantage of antibodies searching directed against nonstructural proteins is a necessity of holding of only one test not depending on serotype or subtype of virus [3].

During producing of "classical" against foot-and-mouth vaccine the virus spreads in vitro in cell culture what causes appearance of proteins of both types. Before using them in order to make vaccines of cell culture they are subjected to high cleaning to eliminate all nonstructural proteins. After, the cleaned virus is inactivated in order not to allow its replication [4]. Immunization by this vaccine brings exclusively to formation of antibodies which are directed against structural proteins.

Until recently the vaccines which provided the animals with steady immunity in the Republic against foot-and-mouth diseases. During the research their serum of the immune ground has been discovered in many of the animals herd. But in recent times eruption of foot-and-mouth diseases occurs among vaccinated animals. Probably this appears because the inactivated cultural vaccines used instead of previous ones can contain the remains of nonstructural proteins which increases antigenicity in case of their entrance into organism under the influence of various factors. Therefore modern production of vaccines demands a high level of cleaning from NSP as it is probably that in more usual (cleaned not enough) vaccines there are NSP which can make the diagnostic work difficult [5,6].

Another essential problem is a right solution of the matters on differential diagnostic of vaccinated animals from virus carriers. It was established that virus carriers appear only after outbreak of infection in the organism of which the virus is multiplied in some degree but not all infected animals show clinical symptoms that is why they remain not unregistered if not to identify them. Virus carriers have danger for not vaccinated cattle [5,6,7].

Presence of nonstructural proteins is a sign of infection of animals in the past. Not infected vaccinated animals must separate only antibodies to structural proteins. Usage of antibodies of nonstructural proteins in equal levels with bacteria to discover infection degree of the vaccinated animals, demands a right choice of antigen of nonstructural proteins during making the enzyme multiplied immunoassay (EIA) what is also a priority target of scientific researches during making the test-system for the diagnostic of foot-and-mouth diseases [8,9,10].

A risk of transferring the disease from virus carriers brings to firm measures of eliminating suspicious animals and also the animals which have contacted with virus carriers.

During making the "classical" against foot-and-mouth diseases vaccines in vitro spreads in cell culture what brings to emergency of proteins of both types. Before using them in order to make vaccines of cell culture they are subjected to high cleaning to eliminate all nonstructural proteins. After, the cleaned virus is inactivated in order not to allow its replication [4, 5]. Immunization by this vaccine brings exclusively to formation of antibodies which are directed against structural proteins.

Therefore modern production of vaccines demands a high level of cleaning from NSP as it is probably that in more usual (cleaned not enough) vaccines there are NSP which can make the diagnostic work difficult [5,6].

So, discovery of antibodies to nonstructural proteins of foot-and-mouth diseases virus is an important instrument of the control of epizootic situation as symptomless virus carriers are found among vaccinated animals. This method allows to differentiate vaccinated animals.

The purpose of the research is to study epizootic situation and an emergency risk of foot-and-mouth diseases in different regions of the Republic of Kazakhstan through discovering antibodies to nonstructural protein of serum virus of the cattle with the help of the test-system CHEKITFMD 3ABCbo-ov).

MATERIALS AND METHODS

Principals of making selection of serum were based on the following:

- Information about infection outbreak in the Republic of Kazakhstan;
- Regions which have been entered the National Program on vaccination;
- Regions which have boarders with the zones of enzootic diseases where ring vaccination is done;
- Geographical position of the region i.e. situation on the boarders with the Republics of Kyrgyzstan, Uzbekistan, China and the Russian Federation.

Blood of animals (10-20% from checked animals) before immunization was used as a material of research and also 6-10 months after vaccination.

All serums have been researched commercially ready for usage by the set CHEKIT 3ABCELISA produced by «BommeliDiagnosticsKit» company. The testing was carried out in accordance with the description of instruction setting and recording of the method. During the EIA setting, the test threshold was established what allowed to evaluate peculiarity and sensibility of the reaction. The research results were considered in optical density (OD). Blood serum of the infected animals showed OD more than 0,20 (positive result), OD of negative control must not exceed 0.5. Difference between positive and negative control must be ≥0.4.

RESULTS AND DISCUSSION

The given results of serological researches of blood serum of the cattle for nonstructural protein of foot-and-mouth-diseases virus show that there is accompanying protein of foot-and-mouth diseases (Table 1, picture 1) in all analyzed regions. Big percent (29,1%) of antibodies against nonstructural protein of foot-and-mouth diseases virus was discovered in the samples in South-Kazakhstan region (27,9%).

Table 1: Results of serological researches of serum of animals for the antibodies against nonstructural protein of foot-and-mouth diseases virus in different regions of the RK in a pattern

Regions	2010		2011		2012	
	Number of tested samples	Number of received samples (%)	Number of tested samples	Number of received samples (%)	Number of tested samples	Number of received samples (%)
Zhambyl	521	65 (12,4)	646	66 (10,2)	400	51 (12,7)
South Kazakhstan	680	198 (29,1)	650	106 (16,3)	690	112 (16,2)
North Kazakhstan	496	0 (0)	446	13 (2,9)	590	12 (2,0)
West Kazakhstan	665	186 (27,9)	385	98 (25,4)	465	81 (17,4)
East Kazakhstan	355	54 (15,2)	390	49 (12,5)	300	45 (15,0)
Almaty	420	36 (8,5)	250	59 (23,6)	365	54 (14,7)
Kyzylorda	475	26 (5,4)	200	14 (7,0)	295	17 (5,7)
Kostanay	290	5 (1,7)	360	0(0)	250	0(0)
Pavlodar	230	4 (2,6)	276	0(0)	240	0(0)
Akmola	300	0 (0)	340	0(0)	309	0(0)
Karagandy	215	0 (0)	275	0(0)	270	0(0)
TOTAL:	**4647**	**574 (12,3)**	**4218**	**405 (9,6)**	**4174**	**372 (9)**

ISSN: 0975-8585

At the same time in 2011-12 the results of positive on nonstructural protein of animals in the indicated regions decrease. Mainly antibodies on NSP were found in Turkestan, Sairam, Ordabasy, Kazygurt areas. These areas are closely located in south part of the region on the crossing of main transport roads and also it boarders with the boarder of Kyrgyzstan.

Number of virus carriers increased in Almaty region in 2011 almost for two times in comparison with 2010. The most number of the animals which carry viruses were found in Enbekshi Kazak (23,6%). More than 14% of the animals which react positively were discovered in Uigur, Karasai, Talgar areas.

In North-Kazakhstan in the samples of blood serum in 2010 nonstructural protein was not found. Research of blood serum in 2011 show presence of protein in 2,9% of researched animals. 2% of the animals which are positive for nonstructural protein were discovered in Mamluytinskiy district.

In Zhambyl region 12,4% of the animals which react to nonstructural protein were discovered. The animals which positively react were found mostly in Zhualy, Baizak, Zhambyl and T. Ryskulov districts.

The lowest percent of the animals which positively react to nonstructural protein was discovered in Kostanay region.

In East-Kazakhstan nonstructural protein of foot-and-mouth diseases virus was found in 15,2% of animals.

In Kyzylorda region the level of infected animals increased up to 7%. Number of animals' samples delivered from Kostanay which react positively to nonstructural protein of foot-and-mouth diseases virus decreases and in 2012 it has not been discovered at all.

Due to the emergency of foot-and-mouth diseases at the territory of the RK in recent years, none of regions can consider itself protected from the risk of infection emergency inside and out.

The highest level of antibodies against nonstructural protein of the virus has been discovered in the samples of blood serums in the regions of South-Kazakhstan and West-Kazakhstan.

The middle level of antibodies has been found in Zhambyl, Almaty and East-Kazakhstan regions.

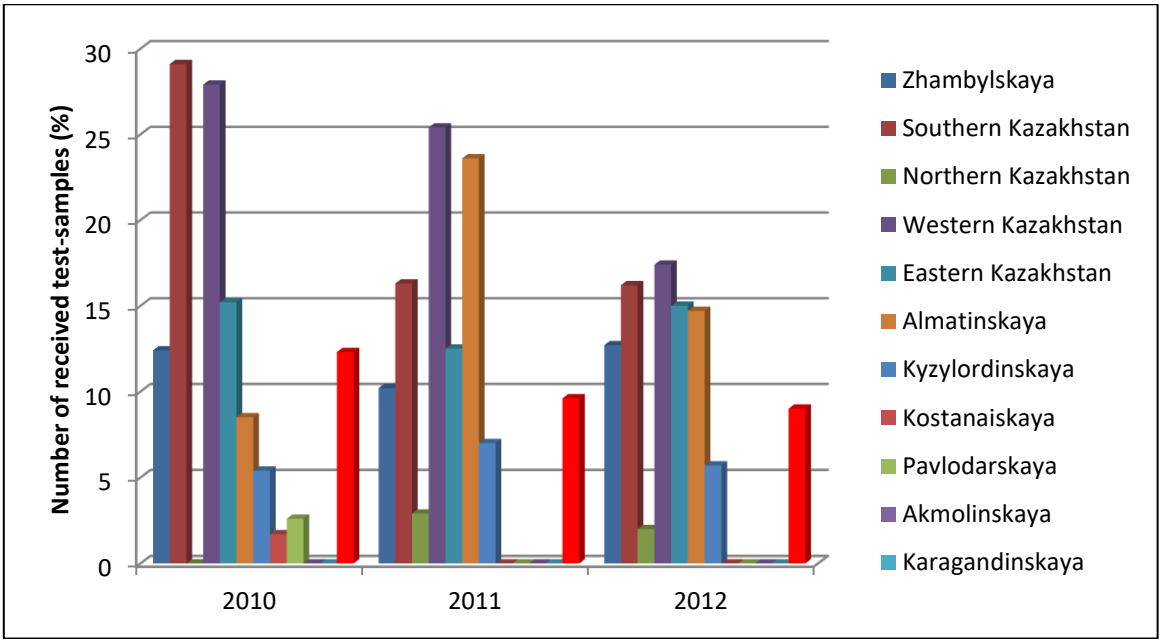

Figure 1: Level of antibodies against nonstructural proteins of foot-and-mouth diseases viruses in different regions of the RK

The lowest level of antibodies has been discovered in Pavlodar, North-Kazakhstan, Kyzylorda and Kostanai regions. Antibodies to nonstructural proteins of foot-and-mouth diseases virus have not been found at all.

The epizootic situation on structureless proteins to foot-and-mouth disease virus by East Kazakhstan region looks as follows. The absolute number of positive tests of 1092 samples was 59, whereas the relative number - 5.4.

On the basis of the obtained data territory zoning of the East-Kazakhstan region was carried out.

The East Kazakhstan region was divided to the zones and subzones according to the data of positive tests on structureless proteins of vaccinate cattle, population density, existence of local, republican and international highways.

The analysis of the figure 2 shows that in four regions of unsuccessful zone of East Kazakhstan – Borodulikhinsky, Zharminsky, Ayaguzsky and Urdzharsky districts the epizootic situation requires special attention. What is more, in 2014 only two regions were belonged to the zone of increased risk, from them Urdzhar area still the place with a high risk, but Zaysan area by the results of 2015 studies was belonged to the observation zone. In Urdzhar area within four years the level of virus-carriage was at one level (9,17-8,6%).

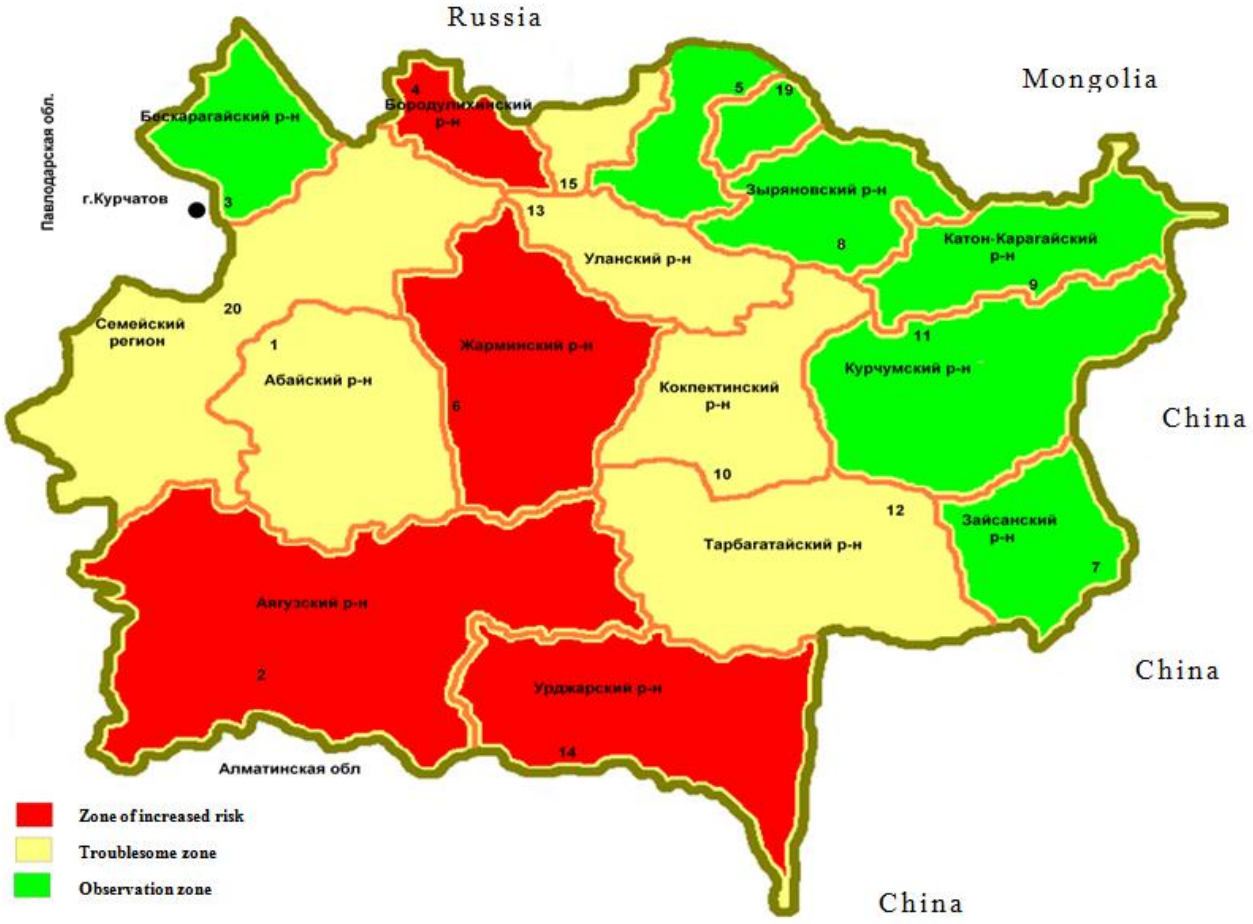

Figure 2: Division of East-Kazakhstan region by foot-and-mouth disease zones

By the results of epizootic and serological monitoring of the foot-and-mouth disease of cattle the East Kazakhstan region was divided into three zones:

1. Zone of increased risk
2. Troublesome zone
3. Observation zone

At present time at East Kazakhstan region there are no operating epizootic centers and that's why we do not plot the unsuccessful zone. Areas, where the number of samples with antibodies to structureless proteins of the foot-and-mouth disease virus of the vaccinated animals were in high level (Urdzhar area) or their quantity have been increased (Borodulikha, Zharma, Ayagoz areas) for the last year, were belonged to the zone of increased risk.

Borodulikha, Zharma, Ayagoz and Urdzhar areas fall into the zone of increased risk. To the troublesome zone Semey, Tarbagatai, Abai, Kokpekty, Shemonaikha and Ulan areas are belonged. Beskaragai, Gluboboye, Kurchum, Ridder (Leninogorsk), Zyryanovsk, Katon-Karagai areas and Ust-Kamenogorsk city belongs to the observation zone.

According to the data of literature source regulations of the Republic of Kazakhstan in epizootic relations with determined countries remain quite serious. From 5 countries which have land borders with Kazakhstan three were not good on foot-and-mouth-diseases in the last years: Kirgiziya (not good in 2010, O type), China (2007 – Asia-1 type), Russia (2005 – O type). The most dangerous countries in relation of possibility to bring foot-and-mouth diseases are located on the perimeter of Kazakhstan: China, Kyrgyzstan, Uzbekistan, Russian Federation.

The next factor which is able to effect essentially to epizootic situation in case of foot-and-mouth disease is a border trade and migration of population. The most intensive border trade is carried out in south-east region with the countries of bad foot-and-mouth diseases, i.t. China, Kyrgyzstan, Uzbekistan. A hard economic condition in the countries of Central Asia and a low economic level of population life leads to that migrant people carry with them (sometimes essential) volume of products (including animal origin) from the regions which are in potential danger of foot-and-mouth-diseases.

Certainly, in the future foot-and-mouth disease will cause a maximum danger for the regions with high density of sensitive animals for a square unit. The following areas belong to such regions: South-Kazakhstan, Zhambyl, Almaty, Kyzylorda, East-Kazakhstan.

The most trouble situation on the risk of bringing foot-and-mouth disease is in southern and eastern and also western parts of Kazakhstan. Although the rest part of central Kazakhstan is subjected to serious risk of bringing foot-and-mouth disease, it is not so troublous as the regions of the first group due to low density of sensitive livestock, disunity of farmlands, low intensity of economic relations. Although South regions are located far from the countries which are bad of foot-and-mouth diseases are also subjected to serious risk due to intensive transport relations, big volume of processing enterprises and exclusive food dependence on the products to be imported.

CONCLUSIONS

- Discovery of antibodies against nonstructural proteins of foot-and-mouth diseases virus allow to determine not only presence of virus carries in the farm business but also to determine a sanitary status of the animals imported from other countries.
- Advantage of antibodies searching directed against nonstructural proteins is a necessity of holding of only one test not depending on serotype or subtype of virus.
- Vaccination in the Republic of Kazakhstan as a measure of necessary specific preventive procedure must be realized as "classical" inactivated against foot-and-mouth vaccination of high cleaning from all nonstructural proteins as none of regions can consider itself protected from the risk of infection emergency inside and out.

REFERENCES

[1] Fomina T.A., Zakharov V.M., Gusev A.A. et.al. Results of Seromonitoring in FMD Buffer Zone in the CIS Countries. Europ.Commiss. Control FMD: Rep.Sess.Res.Group Stand. Techn.Comm. Borovets, Bulgaria, 2000.126-130.

[2] De Diego M, Brocchi E, Mackay DKJ and Simone F.De. Arch Virol, 1997, 142**:** 2021-2033.

[3] Sorensen K.J., Madsen K.G., Madsen E.S., Salt J.S., Nqindi J., Mackay D.K.J. Arch Virol., 1998, 143:1461–1476.

[4] Brocci E., De Diego MI, Berlinzani A, Gamba D., De Simone F. Vet Quar., 1998, 20(2):20.
[5] Berlinzani A, Brocchi E., De Simone F. Performances of 3ABC-trapping ELISA to differentiate infected from vaccinated animals in a field situation: experiences following FMD outbreaks in Albenia. Rpt.Sess. of the Reser.Grp of the Stand. Tech. Comm., Aldershot, UK, 14-18 Sept. 1998. App.22.

[6] Strebel K and Beck E. Journal of Virology, 1986, 58: 893–99.
[7] Gusev A.A., Amadori M., Berlinzani A., Brocchi E., Zakharov V.M., Fomina T.A., Dudnikov S.A., Schekotova O.A. Serosurveilance of FMD in Transcaucasian Countries: role of the 3ABC-ELISA. Europ. Com. Contr. FMD: Sess. Reser. Grp. of the Stand. Tech. Comm., 29 Sept.-1 Oct. 1999, France. Rome, 1999.App. XI.
[8] Juan Lubroth. Serological responses to FMDV nonstructural proteins 2C and 3ABC in a vaccinated South American cattle population in the absence of clinical disease.Rpt.Sess. of the Reser.Grp.of the Stand.Tech. Comm., Aldershot, UK, 18 Sept. 1998.App. 24.
[9] HagaiYadin, Dalia Chai, Boris Gelman, Marge Forsyth and d. Mackay. A field survey of 3ABC and 2C antibodies in different sheep herds in Israel. Rpt. Sess.of the reser. Grp. of the Stan.Techn. Comm., Aldershot, UK, 14-18 Sept. 1998. App.25.
[10] Sorensen K J, Madsen K G, Madsen E S, Salt J S, Nqindi J., Mackay D K. Archives of Virology, 1998, 143:1461–1476.