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THE OVERVIEW OF EPIZOOTIOLOGIC SITUATION OF EQUIDS AND RUMINANTS IN MONGOLIA

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ABSTRACT

Ecological inbalance, global change, new mode of lifestyle and increasing population cause the spread of zoonotic infectious diseases around the world and re-emergence disease among many others. The aim of this article is to summarize the situation of the important infectious diseases of the ruminants and horses in Mongolia. Some of these diseases have zoonotic potential, too. Livestock in Mongolia is an irreplaceable source of livelihood, labour force, means of transport, subsistence and companion as well as important component of the culture in this part of world. However, due to the wide-spread of these animals they also serve as a host and vector for many dangerous infectious diseases. Our overview focuses on the most important infectious diseases,mainly zoonoses in Mongolia and its current epizootologic status. People may be infected during contact with infected animals, though a more frequent path of infection is via foodstuffs of animal origin. Re-emerging infectious diseases are diseases that are already familiar to us and their increased occurrence is associated with a change in the process of transmission of infection.

KEYWORDS: infectious diseases, zoonoses, livestock, prevalence, one health

INTRODUCTION

Ecological unbalance, global changing, new mode of lifestyle and population increasing such as many causes the spread of zoonotic infectious diseases around the world and re-emergence disease. The review shows, that a lot of severe infectious diseases still occurs in horses and cattle in Mongolia and most of these (re-) emerging diseases are zoonoses as well. That increases the point of eliminating these diseases. In the middle of 1960's large expeditions were organized the former eastern bloc satellite countries and sharply decreased the prevalance of these infections. Czechoslovak veterinary expeditions carried out during 1966-1968 mass investigations of selected zoonoses in all herds of two Mongolian aimags–Bulgan and Uvurkhangai. Total number of serological investigations on brucellosis reached 2588912. Total number of allergic testing on tuberculosis reached 680.025 and

of allergic testing on glanders reached 618918 animals, i.e. total number of all investigations was 3887855. The results according to individual animal species were as follows: **brucellosis**–26957 camels (919 positive, i.e. 3.41%), 336.256 cattle (18619 positive, i.e. 5.54%), 1796639 sheep (21.561 positive, i.e. 1.20%), 428021 goats (4018 positive, i.e. 0.94%), 467 pigs (1 positive, i.e. 0.21%) **tuberculosis**-677402 cattle (427 positive, i.e. 0.06%), **glanders**–603055 horses (18073 positive, i.e. 3%) and 15863 camels (2 positive, i.e. 0.01%) [30]. Major political parts and healthcare system changes began in 1990; Mongolia has aborted a new economic system by disbanding state collectives and privatizing the veterinary sector. In the recent years have been newly diagnosed the following diseases in livestocks of Mongolia: the **ovine pulmonary adenomatosis** (Lun soum, Tuv aimag, Bayannuur and Buregkhangai soums, Bulgan aimag in 2006 and 2010), **maedi-visna** (Eruu, Khuder, Tushig and Zuunburen soums, Selenge aimag in 2007-2008), the **bluetongue disease** of sheep (in the most soums of the steppe-forest region in 2007-2010), **West Nile virus infection** (Khovd and Bayan-Ulgii aimag in 2004, and Khovd, Khuvsgul, Bulgan and Darkhan-uul aimags in 2007), **porcine reproductive and respiratory syndrome** (Ulaanbaatar in 2007 and 2010), **tick-borne encephalitis** (Eruu and Khuder soums, Selenge aimag and Khyalgant soum, Bulgan aimag, Dashbalbar soum, Dornod aimag in 2008-2009), **avian influenza** (Erkhel lake, Alagerdene soum, Khuvsgul aimag, Khunt lake, Saikhan soum, Bulgan aimag in 2005, Doitiin tsagaan and Duruu tsagaan lakes, Ugiinuur and Tsetserleg soums, Arkhangai aimag in 2006-2008 and Ganga lake, Dariganga soum, Sukhbaatar aimag in 2009-2010), **Newcastle disease** (Ulaanbaatar in 2010), **bovine respiratory syncytial virus infection** (Eruu, Khuder and Altanbulag soums, Selenge aimag in 2008). Also, some diseases like **foot and mouth disease (FMD)** considered as eliminated have been re-emerged in eastern provinces after 26 years in 2000-2010, **sheep pox** re-emerged after 29 years in 2006, and **capripoxivirus** infection re-emerged after 41 years in 2008 [6] in Mongolian animals. In other hand for the above system to function there may be the need for new legislation as currently the on-farm herd register do not have to be electronically based. It is mainly concerned with the identification of animals by use of ear tags containing barcodes and the authorisation of movement [37; 49; 50]. Collaborating across sectors that have a direct or indirect impact on health involves thinking and working across silos and optimizing resources and efforts while respecting the autonomy of the various sectors. To improve the effectiveness of the One Health approach, there is a need to establish a better sectoral balance among existing groups and networks, especially between veterinarians and physicians, and to increase the participation of environmental and wildlife health practitioners, as well as social scientists and development actors. As this kind of collaboration newly introduced in Mongolia, there are numerous complications and difficulties may arise, that eventually could lead to the results, with higher negative impact to the public and personal health. [3].

VIRAL DISEASES

Rabies was documented in poems, literature and initial medical texts since 11th and 12th century BC. It is acute viral encephalomyelitis caused by viral agents from *Lyssavirus* genus. The transmission to a man is realized through biting or scratching or through contact with salivas from whatever infected animal [42]. The rabies occurs worldwide except Antarctica and a few islands. This disease remains a serious health problem all over the world. Basely on WHO statistic, 55.000 people die of it every year, predominantly in Asia and Africa [29]. This dangerous disease was determined as neglected tropical disease, because of lack of awareness in the general public and medical professionals from WHO [62]. Whereas the rabies occurs only rarely in most of people in the East Europe, it still persists in reservoir animals, where the postexposive antibodies are present, primarily in the countries situated on the crossroads of the Asia, Africa and Western Europe [26; 38]. The fact, that rabies is still a big problem also in the Far East, reported [19] and makes mentions, that the most important factor is the failure to immunize domestic dogs, which transmit rabies to humans. The author points out the importance of initiating mass vaccination campaigns in dog population in these countries in order to stop the occurence of human rabies. The gold standard for diagnosis of a rabies in animals is direct immunofluorescent assay (DFA). Reverse transcriptase polymerase chain reaction (RT-PCR) and direct rapid immunohistochemical test (dRIT) are mostly recommended. DFA requires fluorescent microscope that is not always available in many parts of the world. Just alike RT-PCR, which

requires sophisticated laboratories. The recently developed dRIT overcomes these disadvantages. In this method, anti-rabies antibodies are labeled with peroxidase and the test requires no specialized equipment or infrastructure, which makes this method ideal for testing under field conditions and in developing countries with limited diagnostic resources [20]. Molecular characterization has indicated that Mongolian strain was steppe-type virus clade consisting of two sub-clades; the Subclade A might be prevalent in Altai, Khangai, Khentii Mountains as a major genotype, whereas the Subclade B seems to be cosmopolitan in the steppe-type virus clade, is spread in northern central Eurasia [54]. These studies have confirmed RABV in domestic and some wild animals. Some inverstigators were determinated the recombinant plasmid that contains the full length nucleoprotein gene (N) of rabies virus CVS-11[5]. It is also essential to improve preventing measures of human rabies including: first - to make anti-infection measures based on that resources of infection are wolves, for dogs infected with rabies and domestic and wild animals bit by infected animals; second–a rabies vaccine needs to be made from cell culture [52]. **Foot and mouth disease** virus (FMDV) belongs to the family *Picornaviridae*, which includes 7 serotypes (O, A, C, SAT1, SAT2, SAT3, and Asia I) and many subtypes [22]. FMD is a highly contagious and outbursting infectious disease in cloven-hoofed animals. Although the mortality in adult animals is not high, its mortality in young animals is relatively high. After infection, the morbidity in animals reaches even 100% [43]. This severe disease infects many animals and causes serious economic, political, and social problems [51]. FMD is endemic in a many part of the world and globalization increases the risk of occasional introductions in a FMD-free countries [39]. Mongolia is a spacious country with a nomadic livestock production system with a large FMD susceptible population consisting of around 20 millions sheep, 19 millions goats, 3 millions cattle and very few pigs [41]. Between 2000 to 2010 eight outbreaks occurred in Mongolia, primarily in the Eastern part of the country, but the disease never seemed to have become endemic. No outbreaks were reported from December 2010 until summer 2013 [1]. The FMD risk assessment in Mongolia was successfully conducted by local experts with the support of international moderators [61]. Following the FMD outbreaks reported in Khovd, in February and March 2015, the events are reported as continuing. The control measures being applied are: quarantine, movement control inside the country, screening, zoning, vaccination in response to the outbreaks with no treatment of affected animals [21]. During 2015, three outbreaks reported in Mongolia, Bulgan soum, Khovd aimag; Altai soum, Bayan-ulgii; Uulbayan soum, Sukhbaatar aimags (provinces) all caused by O serotype [23]. **Equine Influenza** A (H3N8) virus (EIV) remains a major cause of acute respiratory infections in horses [12]. Epizootics are highly explosive and spread rapidly within and among equine premises. Virus transmission is by direct contact and inhalation. First isolated in 1963, EIV has evolved and diverged into American and Eurasian lineages [13; 34]. It is highly contagious respiratory virus; in naive horses a hacking cough is typically associated with marked pyrexia, inappetance and lymphadenopathy [44].

In Mongolia was the first outbreak of this disease in winter 1974 it has started from Bulgan soum in Khovd Aimag and spread all over the country [17]. Since that time, the outbreak of the influenza was recorded in 1983–1984, 1993–1994 and 2007–2008. At the height of epizootics in 1993 and 39.8% of total horses in Mongolia was infected. According to some authors, the occurence of influenza epizootic can be related with solar activity [17]. A total of 745 samples were collected from the three aimags between January and September 2011. Swab specimens positive for influenza were found in the months of May (13 horses), June (1 horse), August (10 horses), and September (10 horses) [59]. **Flaviviruses in horses.** The West Nile Fever Virus (VNF), Japanese Encephalitis Virus (JEV), Dengue Virus (DV), Muray Valley Encephalitis Virus (MVE), St Louis Encephalitis Virus (SLEV) and Hepatitis C Virus (HCV) belong to the same family–*Flaviviridae* (FV). These RNA viruses has significant neuroinvasive character and are regarded as neurotropic viruses. As natural reservoir serve horses, pigs, birds (*Corvid* species) and dogs [14; 33; 56; 57]. Humans are considered to be “dead end hosts” because they are infected accidentally when bitten by a Flavivirus (FV) carrying mosquito, usually from the *Culex* species (WNF, JEV) [33; 56]; the *Aedes aegypti* and albopictus mosquitoes are responsible for DV infection [32]. In study of [4] detected antibodies for Japanese Encephalitis Virus (JEV) and West Nile Virus (WNV) from Mongolian horses. From 257 serum samples through virus neutralization test were 37 found JEV positive and all of these positive serum samples were found and those serum were used to differentiate WNV and JEV, using blocking ELISA and plague reduction neutralization test (PRNT). There was no positive antibody against WNV in that study.

BACTERIAL DISEASES

The causative agent of **anthrax** is *Bacillus anthracis*, a gram-positive spore-forming bacterium It is important to mention that the spore is the only infectious form of *B. anthracis* outside of the laboratory [11]. In a natural environment anthrax is predominantly a disease of herbivores feeding on vegetation from fields contaminated with spores of *B. anthracis*. Carnivores can be infected by *B. anthracis* when feeding on animals which died as a result of anthrax [24; 35; 55]. There are three major forms of anthrax in humans as defined by the route of spore exposure: cutaneous, gastrointestinal and inhalational [15]. How presents [7] in Mongolia, natural foci of anthrax was determined in 19 aimags, 1 city and 188 soums and districts out of 21 aimags, city, 340 districts and soums. However, authors also give out, that the number of human anthrax was increased in the recent years and the border of the natural foci has been extended to the Gobi region, particularly in the Gobi-Altai, Dundgobi aimags. Outbreak has been recorded in Selenge aimag. Between years 2000–2011 have been recorded 216 cases and 15 was fatal [8]. Because of these facts runs also a researches to prevent this disease, like detection of antiobody against *B. anthracis* PA in un-vaccinated livestock [18]. Total of 271 human anthrax cases were registered from 1964-2011. The overall case fatality rate was 19 (7.0%) in last four decades, but recent outbreak was 5 (38.5%). Animal anthrax has been increasing since 1990, human anthrax cases has been increasing since 1996. The spatial distribution of human and animal anthrax was consistent. Most animals and human anthrax cases occurred May-Sept 252 (97.2%) of cases were cutaneous form (96% of skin lesion on hand and face) in Mongolia. Most human cases were working-age people; however recent outbreak mostly affected elderly. Men have affected 3 time higher risk than women, however, gap between man and woman is becoming narrow recent years. Environmental samples anthrax positive dramatically increasing *B. anthracis* positive [58]. **Brucellosis** is an important zoonotic disease, which causes severe economic losses. The most of domestic animal species can be affected. The disease is characterized by reproductive disorders, particularly abortion in the last trimester of the gestation and placentitis in females and epididymitis, seminal vesiculitis and orchitis with consequent sterility in males [36; 45]. This infection disease, particularly caused by *Brucella melitensis*, remains one of the most common zoonotic diseases worldwide with more than 500,000 human cases reported every year. The geographical distribution of brucellosis is incessantly changing with new foci emerging or re-emerging [45]. This confirms the study of [46] too. In their cross-sectional study they determine a brucellosis seroprevalence among rural people (total 2282) in six aimags of Mongolia (Arkhangai, Khuvsgul, Selenge, Uvs, Umnugovi and Govi-Altai) between November 2011 and January 2012. General apparent seroprevalence of *Brucella* spp among these people was estimated at 15.6% and ranged between the 6 aimags from 10.9% to 18.9%. Evident seroprevalences among veterinarians were 45.4%. The brucellosis seroprevalence among rural poeple is high and mass vaccination of livestock is necessary to stop the transmission[46].

PARASITIC DISEASES

Toxoplasmosis is an important zoonotic disease with a global distribution. Humans can be infected through ingestion of oocysts, for example contaminating water or food or by contact with cats. Epidemiological evidence indicates that in most countries humans are infected more frequently through the consumption of insufficient cooked meat containing viable bradyzoites [40]. The most well known consequence of toxoplasmosis is via maternal infection for the first time during pregnancy and can result in foetal death, neonatal death or various congenital defects, such as hydrocephalus, other CNS disorders and chorioretrinitis [31]. In study from [53] the seroprevalence of *T. gondii* infection in sheep in Mongolia was investigated using ELISA with rTgMAG1. Serum samples (175) were collected from seven provinces in Mongolia and were examinated by ELISA, and the results were compared with those from the commercial LAT. Both test showed high compliance–the ELISA detected 24% infectious rate, seems to be more specific than the LAT detected 16.5% infectious rate in ovine samples. **Cryptosporidiosis** is a primary cause by oocysts of genus *Cryptosporidium* and diarrhoeal clinical features in humans are known in all over the world [47; 48] Two children were infected with *Cryptosporidium parvum* in Selenge aimag in Mongolia [25]. Some species of

Cryptosporidium use a zoonotic transmission for human and animals [27].

The presence of oocysts in 460 animals (439 cattle, 16 kids, and 5 sheep) of Tuv-aimag Mongolian district was investigated by IFT. *Cryptosporidium* oocysts were found in 116 (26.4%) cattle. Out of the 116 IFT positive samples, 47 were further purified by IMS, investigated by PCR and 11 were found positive. The species and/or genotypes were determined by nested PCR-RFLP and sequence analysis of a fragment of the SSU rRNA gene. The results indicated the presence of *Cryptosporidium andersoni* in the sequenced samples and *C. bovis* in two samples as a common infection [9]. Disease caused *Cryptosporidium* is typically characterized by profuse, watery, bloodless diarrhea. Other symptoms can include loss of weight, abdominal pain, anorexia, fatigue, cramps, headache, fever, and emesion [60]. In a study of [27] were explored fecal samples of 11 calves (6-8 months) from Batsumber soum of Tuv aimag and 10 calves (one month) of Atalay breed from Argunt, close to Ulaanbaatar. Oocyst of *Cryptosporidium* were identified in 12 (30%) fecal samples. We were collected from calves fecel 3379 samples in three different geographical zones (including 12 aimags and 67 soums). *Cryptosporidium* oocysts were found in 219 (6.48%) calves. The species and/or genotypes were determined by nested PCR-RFLP. The results indicated the presence of *C. andersoni* and *C. parvum* [28]. **Echinococcosis,** also known as hydatid disease, is a potentially lethal condition caused by cestodes of the genus *Echinococcus* [16]. This genus contains six species of cyclophyllid tapeworms of the family *Taeniidae* and all species are zoonotic. The research of *Echinococcus* spp. started in about 1930 in Mongolia and 26.5% of all of the dogs of the Ulaanbaatar area were infected by *Echinococcus* spp. In [2] notified, that 21.9% of 6465 slaughetred sheep were infected by *Echinococcus* spp.

A total of 62 people (9.1%) revealed significantly high levels of specific antibiodies against *Echinococcus granulosus* by enzyme-linked immunosorbent assays (ELISA) [25]. In the study of [10] they reported, that from total 1707 serum samples were 9.2% (31 out of 338) goat, 3.6% (21 out of 590) of sheep and 5.9% (46 out of 779) cattle shown aimag.

CONCLUDING REMARKS

Mongolia needs to strengthen zoonotic disease surveillance and response capabilities at the national level, and this requires a substantial and long-term commitment of human, financial and material resources. Consequently, an experienced consultant is needed to guide national experts through the process of undertaking impact evaluations for zoonoses in people and animals, and using this to set priorities for surveillance and control activities for significant zoonoses in Mongolia. From the technical perspective, it is undoubtfully important to evaluate the system and reveal the gap and weakness of each stakeholder in this important network and try to introduce common standard operational procedures for the handling and maintaining infective agents to avoid the unpleasant spill over the pathogen into the environment [3].An intersectoral committee on zoonoses was established in 2010 at national level, and this committee has to periodically assess the surveillance and control system so that this continues to reflect national zoonotic diseases control priorities, improves efficiency and takes advantages of new methods and techniques to strengthen surveillance in both human and veterinary sectors including wildlife. Preventive measurements, complex approach in compliance with newest knowledge and experiences in the field of infectious diseases and zoonoses and international cooperation are necessary for successfull prevention to spread of the disease.

CONFLICT OF INTERESTS

The authors declare no conflict of interests regarding the study described in the paper.

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