

The incidence of people and animals with echinococcosis in the Kostanay region of the Republic of Kazakhstan

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The aim of the research was to study the distribution of echinococcosis in humans and animals in the Kostanay region of the Republic of Kazakhstan. Research on the diagnosis of echinococcosis in humans was carried out in the Kostanay branch of the "Scientific and Practical Center for Sanitary and Epidemiological Expertise and Monitoring" of Ministry of Health of the Republic of Kazakhstan in 2000-2015. In order to establish the degree of invasion of dogs by echinococcus, fecal samples in the Kostanay region, in the areas where cases of echinococcosis in humans were registered, were taken. The incidence among the population of various age groups in the region was analyzed according to the results of studies of blood samples by enzyme-linked immunosorbent assay (ELISA) and lung radiography. It has been established that echinococcosis is a widespread disease among people living not only in the Kostanay region, but also in the Republic of Kazakhstan on the whole. Between 2000 and 2019 the number of patients with echinococcosis in the Kostanay region amounted to 249 cases. The smallest number of cases (5) was registered in 2000, and the largest in 2014-26 cases. In the years of 2002-2015. the incidence rate of echinococcosis in humans did not decrease and ranged from 1.6% to 1.5% per 100.0 thousand people. The maximum number of positive reactions by ELISA for echinococcosis was recorded in 2003, 2005, 2006 and from 2013 to 2016, when the incidence rate of people was 0.9%; 0.8%; 0.26%; 1.8%, 3.0%; 1.5%; 0.9% respectively. The peak incidence of human echinococcosis occurred in 2014 and amounted to 3.0%. The analysis of the registration of cases of echinococcosis among people of different age groups showed that out of 8 cases in 2016, 3 cases were in the population under the age of 14 and its infection rate per 100.0 thousand amounted to 1.74%. In 2017, out of 7 registered cases of the incidence of echinococcosis in humans- 2 cases were in the population under the age of 14 and its infection rate per 100.0 thousand was 1.14%. The maximum number of cases of echinococcosis in 2011-2017 was recorded in sheep, the invasion rate of Echinococcus granulosus being 3.1%, 3.5%, 4.2%, 3.1%, 5.6%, 3.0%, 2.8% respectively, while the average invasion in sheep amounted to 1.5%. There were no cases of registration of echinococcosis in horses. Judging by the results of the comparative analysis of the epizootic and epidemiological situation of echinococcosis in the Kostanay region, it should be noted that echinococcus infection occurs in all areas of the region, with approximately the same level of development of livestock production and a large number of dogs.

Keywords: Echinococcus; Incidence; Human; Invasion; Dog; Dynamics; Infection

Introduction

Echinococcosis is an important social problem, the disease causes significant economic damage to livestock and poses a serious threat to humans (Eckert, 2004; Abdybekova, et al. 2015). In humans and animals, liver and lungs are mainly affected by echinococci, but other organs such as kidneys, heart, spleen, reproductive organs, and the brain may be affected as well. The main source of the spread of invasion is dogs scattering with feces the eggs of *E. granulosus* from the *Taeniidae* family (Torgerson, et al. 2008; Alvarez, 2014; Kapel, 2014). The epidemic role of echinococcosis as a socially dangerous helminthiasis is an important public health problem in the world. Infection of a person with echinococcus oncospheres occurs by contact with invasive dogs, skinning of wild carnivores of the *Canidae* family and the consumption of accidentally contaminated products (Torgerson, et al. 2008; Kapel, 2014; Torgerson, 2010). The incidence of echinococcosis in 2008-2012 in Europe amounted to 0.14-15.8 people per 100 thousand of the population (Torgerson, 2010; Deplazes, 2017; Schweiger, et al. 2017; Bruzinskaite, 2007; Hahorski, et al. 2013), in Central Asia-2.7-14.5 (Abdybekova, et al. 2015; Torgerson, et al. 2008; Gagarin, 1957; Khademvatan: 2018), in Russia- 0.3 (Abdybekova, et al. 2015; Kapel, 2006; Deplazes, 2017) More than 300 cases of human disease have been reported in Japan on the islands of Hokkaido and Rebun, where over the past two decades the number of foxes the infection rate of which with echinococcus amounted to 58% has risen. In Western China, dogs are infested by *E. granulosus* in 56% of cases, and the incidence of echinococcosis in humans ranges from 0.39 to 30% (Ma, 2015; Vuitton, 2011). In Uruguay, using special research methods, it was found out that 3.5-5.6% of the population are carriers of hydatid echinococci (Alvarez, 2014; Torgerson, et al. 2008; Deplazes, 2017). In Kazakhstan, the incidence of the population (according to incomplete data) with echinococcosis is from 2.4 to 6.8%. In 2011 2018 984 people got sick. At the same time, from 3.5% to 8.7% become disabled, from 6.2 to 15.5% of patients are re-operated due to relapse of the disease (Eckert, 2004; Abdybekova, et al. 2015; Deplazes, 2017).

Among children cases of incidence of 3-6 year olds were observed. A significant incidence of people was noted at the age of 20-30. The greatest number of diseases is registered in people aged 30-50 years. Also quite frequently echinococcosis occurs in the elderly. Of the people with echinococcosis 54.5% were females and 45.5% were males. According to the Republican Sanitary and Epidemiological Service, the incidence is very significant depending on the place of residence: 68.8% of patients are residents of rural areas and 31.2% are residents of the city. In this case, most often in the anamnesis of the sick the connection with agriculture or close contact with animals are revealed. Due to the lack of public awareness, pets are allowed to go outside every year where they become stray ones. Because of breach of the rules of keeping animals and walking dogs in settlements, there is a risk of infection from sick animals scattering with their feces the eggs of *E. granulosus* on playgrounds, parks and ponds in cities and on farms and pastures in the countryside. The spread of echinococcosis in settlements is due to the lack of a systematic approach to controlling the number of stray dogs. In addition, echinococcosis is a highly endemic disease in Kazakhstan, and there is a lot of evidence that the incidence rate in humans has risen sharply in recent years. According to numerous data from foreign and domestic researchers, the causative agent of echinococcosis in intermediate hosts and in definitive hosts is *E. granulosus*.

The causative agent of echinococcosis during life of intermediate hosts, in particular farm animals, does not leave the body. However, there are definite transmission mechanisms. Echinococcosis is spread almost everywhere, and human infection with echinococcus oncospheres occurs through contact with invasive dogs (there are some data that prove it obtained by us as a result of studies of dogs). In the veterinary clinics of Kostanay in the period of 2011-2018 6579 dogs were examined among which during their life no cases of echinococcosis were revealed. Given the significance of the problem and the lack of up-to-date knowledge about the spread of echinococcosis in the Kostanay region, the goal was set: to study how echinococcosis is spread in humans and animals.

Materials and Methods

Research on the diagnosis of echinococcosis in humans was carried out in the Kostanay branch of the "Scientific and Practical Center for Sanitary and Epidemiological Expertise and Monitoring" of the Ministry of Health of the Republic of Kazakhstan in 2012-2017. The incidence among the population of the region was analyzed according to the results of the studies of serological blood reactions to echinococcosis. These reactions are based on the interaction of parasite antigens and specific host antibodies, and they confirm the presence of echinococcal invasion. RGA, the reaction of latex agglutination, RFA and ELISA, the reaction of scolex precipitation, RNIF and RSK were used. The most effective in the diagnosis of this echinococcosis appeared to be an enzyme-linked immunosorbent assay. Using it, antibodies (class G immunoglobulins) to helminth antigens were determined. To confirm the diagnosis of echinococcosis in the blood serum, an antibody titer was determined, the ratio of 1:100 being considered a negative reaction. With the ratio of more than 1:100, the reaction is considered positive or the person is diagnosed as infected with parasites. Instrumental methods of radiography of the lungs, chest, and angiography of the celiac trunk (for liver echinococcosis) were additionally used. To diagnose echinococcosis in animals at meat processing plants in the Kostanay region, post-mortem examination was carried out. In order to establish the incidence of dogs with echinococcosis, feces on the territories, where there were the cases of the disease in humans in 2015-2018 were sampled.

Results and Findings

It has been established that echinococcosis is a widespread disease among people living in the Kostanay region. Between 2000 and 2019 the number of patients with Echinococcosis in the Kostanay region amounted to 249 cases. The smallest number of cases (5) was registered in 2000, and the largest (26) were registered in 2014. In the years of 2002-2015 the incidence rate of people with echinococcosis did not decrease and ranged from 1.6% to 1.5% per 100.0 thousand of the population. The epidemiological situation of echinococcosis of people has been constantly changing and the incidence rate of the population varies from 0.5% to 3.0% per 100.0 thousand of the population. The lowest incidence of human echinococcosis of 0.5% was recorded in 2000. The recount of cases of the disease per 100 thousand people indicates that this type of zoonotic invasion in 2014 was prevalent in the Arkalyk, Auliekol and Karasu regions, where the incidence rate was 3.3%; 3.0%; 2.7% per 100 thousand of the population respectively. In the same year, the maximum incidence rate of echinococcosis in the region, which amounted to 3.0% per 100 thousand of the population, was recorded as well. The maximum number of positive reactions to echinococcosis was recorded in 2003, 2005, 2006

and from 2013 to 2016, when the incidence rate in people was 0.9%; 0.8%; 0.26%, 1.8%, 3.0%, 1.5%, 0.9% respectively (Figure 1).

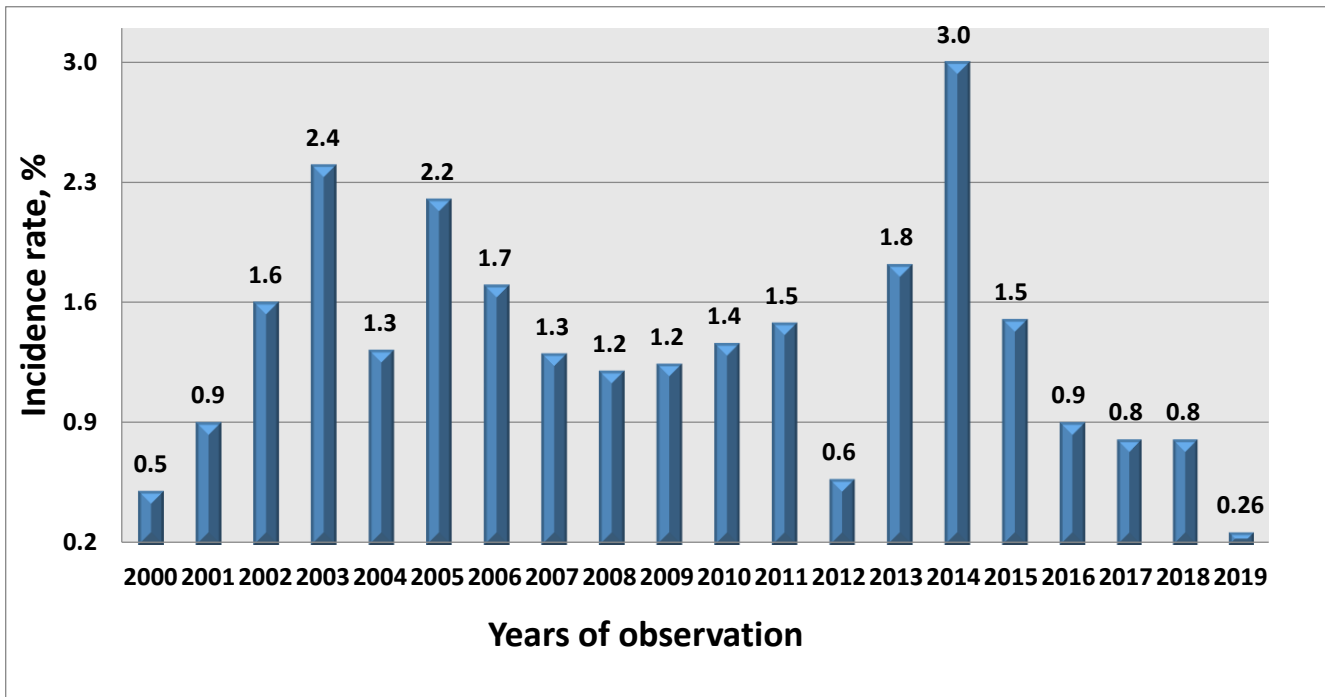


Figure 1. The dynamics of the incidence of echinococcosis in humans in the Kostanay region for 2000-2019.

In addition, in 2006–2015 the incidence rate of echinococcosis among children aged 0 to 14 years was studied (Figure 2).

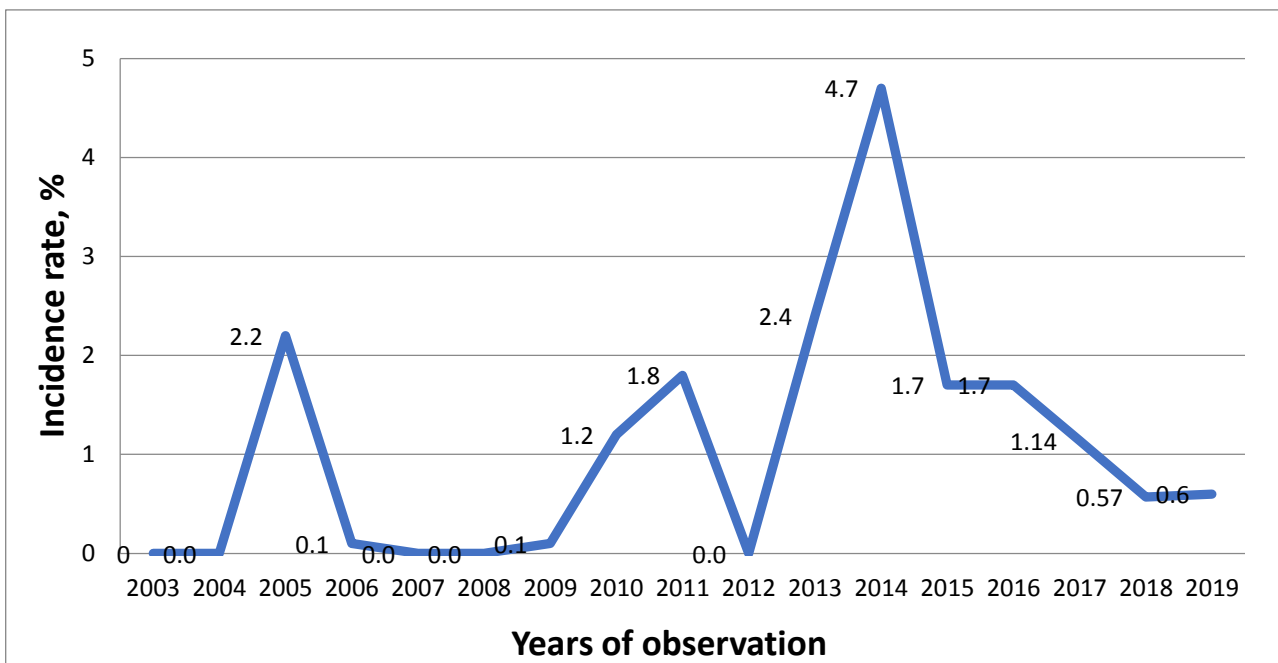


Figure 2. The dynamics of the incidence of echinococcosis in children aged 0-14 in the Kostanay region for 2004-2019.

It was found out that out of 249 cases of echinococcosis in people, 41 cases occurred in the population under the age of 14 and its infection rate per 100.0 thousand amounted to 1.3%. Peaks of invasion were registered in 2005, 2011, 2013, 2014 and 2016, when the incidence rate of echinococcosis in children was 2.2%; 1.8%, 2.4%; 4.7% and 1.7% respectively, per 100 thousand people. Simultaneously with the immunological diagnostic method in the population of the Kostanay region in 2013-2019 a study of the species composition of helminths in dogs was conducted. According to researchers, the study of the spread of helminthiases, the intensity and intensity of invasion is necessary for learning of epizootology of helminthiases. This is the basis for the development of integrated measures for the prevention and treatment of dangerous zoonoses. To determine the initial invasion of dogs by *E. granulosus* a total of 640 feces samples were collected in the Kostanay region, of which 152 samples were taken from Kostanay, 120 samples- from Rudny, 218 samples- from the village of Urpek of the Amangeldy district and 150 samples- from the Arkalyk district. In the parasitology laboratory of "KazNIVI" LLP we performed helminthovoscopy of the collected feces samples applying the Darling method using the Para SYS system (Figure 3).

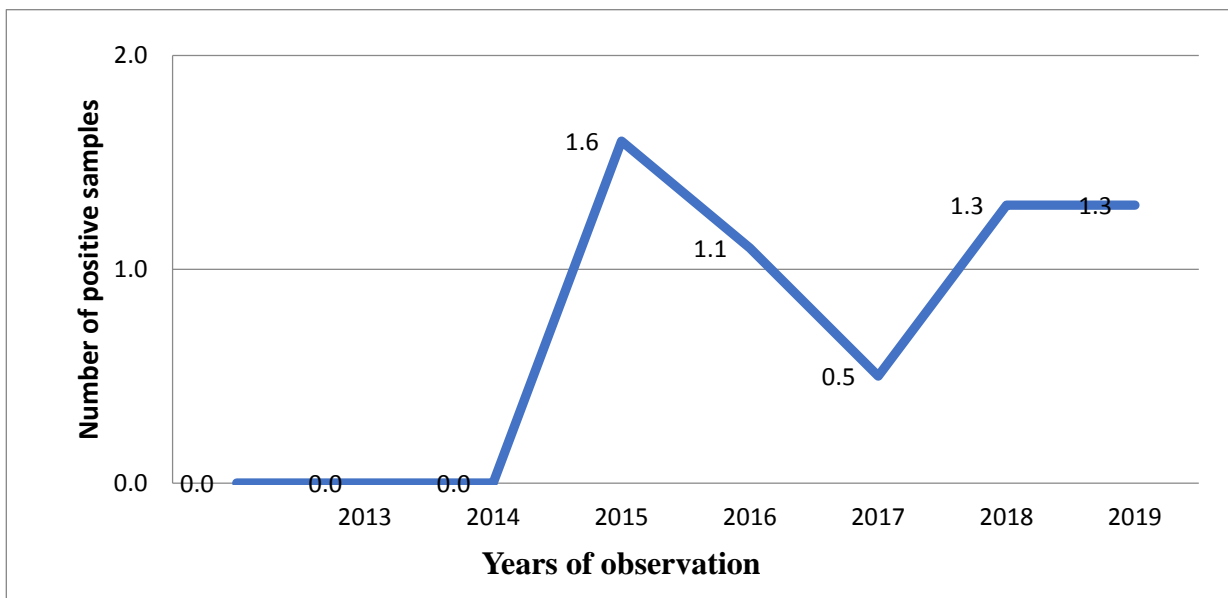


Figure 3. The results of a coprological study of fecal samples from dogs on the detection of helminth eggs of the *Taeniidae* family in the Kostanay region (2015-2019).

The result of a coprological study in 2015 of 120 samples of feces of dogs from Rudny shows that 30 (25%) animals were infected with various types of helminths with AI from 2 to 18 eggs. Out of 120 dogs 2 (1.6%) had helminth eggs of the *Taeniidae* family. The result of a coprological study in 2015-2017 of 218 dogs in the village of Urpek of the Amangeldy district of the Kostanay region shows that 48 (22%) animals were infected with various types of helminths with AI from 1 to 14 eggs. Out of 218 dogs 3 (1.4%) had helminth eggs of the *Taeniidae* family. Out of 205 dogs in 2015 2 (1.1%) and in 2017 out of 198 in 1 (0.5%) had helminth eggs of the *Taeniidae* family. The result of a coprological study of samples from 150 dogs from the Arkalyk district in 2018-2019 shows that 2 (1.3%) dogs had helminth eggs of the *Taeniidae* family with AI of 3-11 eggs. To prevent the spread of echinococcosis among farm animals in the Kostanay region veterinary specialists conduct preventive deworming of dogs. Dogs should be dewormed at special sites where dogs' feces are collected into a metal container and neutralized by boiling for 10-15 minutes or soaking in a 10% solution of bleach for 3 hours, and the soil at the deworming site is treated with 3% caustic soda solution. According to the results of monitoring and analysis of veterinary reports for 2000-2019, there have not been registered any hazardous areas with regards to echinococcosis in animals. However, the results of joint studies with the veterinary service of the region during veterinary and sanitary examination of meat at slaughterhouses and markets showed that echinococcosis is spread among farm animals. To identify echinococcosis in cattle, sheep, pigs and horses, we went to the slaughter facilities of the region, where, together with veterinarians, we carried out veterinary and sanitary examination in accordance with the current veterinary and sanitary rules, approved by order of the Minister of Agriculture of the Republic of Kazakhstan dated June 29, 2015 No. 7-1/587. In the Kostanay region as of 01.01.2020, there are the following farm animals: 408,747 heads of cattle, 117,975 heads of horses, 396,606 heads of sheep, 126,620 heads of pigs. Analysis of the dynamics of the number of farm animals in 2010-2019 indicates a slight reduction in their stock, the number of horses on the contrary being increased by 46,011 heads, that is, by 8%. Simultaneously, the number of positive cases of registration of echinococcosis was noted in 2011-2014, the extent of invasion of *E. granulosus* in cattle was 3.3%, 3.2%, 3.5%, 3.6% respectively, and the average invasion in cattle was 1.2%. In 2012-2015 the extent of invasion of *E. granulosus* among pigs was 2.2%, 2.2%, 2.5%, 2.1% respectively, and the average invasion of pigs was 0.9%. The maximum number of cases of echinococcosis in 2011-2017 was recorded in sheep, the extent of invasion of *E. granulosus* was 3.1%, 3.5%, 4.2%, 3.1%, 5.6%, 3.0%, 2.8% respectively, and the average incidence of sheep was 1.5%. There were no cases of registration of echinococcosis among horses (Figure 4).

Discussion

According to the veterinary service in the Kostanay region since 2015, 32 slaughterhouses of farm animals have been operating, which ensures veterinary and sanitary safety of 17 districts and 3 cities on 97%. Each slaughterhouse is assigned a veterinarian of local executive bodies and laboratories that ensure veterinary and sanitary safety of products. The results of studies of echinococcal infection of animals were compared with indicators of infection in the population. The indicator calculated per 100 thousand people in the Kostanay region in 2000-2019 was 1.5%. According to the above data, there is a decrease in cases of registration of echinococcosis among residents of the region. As a result of the studies, it was found out that dogs are the main source of echinococcosis invasion in the Kostanay region, and farm animals and humans are intermediate hosts. Based on a comparative analysis of the epizootic and epidemiological situation of echinococcosis in the Kostanay region, it should be noted that echinococcosis infection of the population occurs in all areas of the region, with approximately the same level of development of livestock production and a large number of dogs. In 2018, 7 cases of echinococcosis were recorded, the infection rate per 100.0 thousand population being 1.13%.

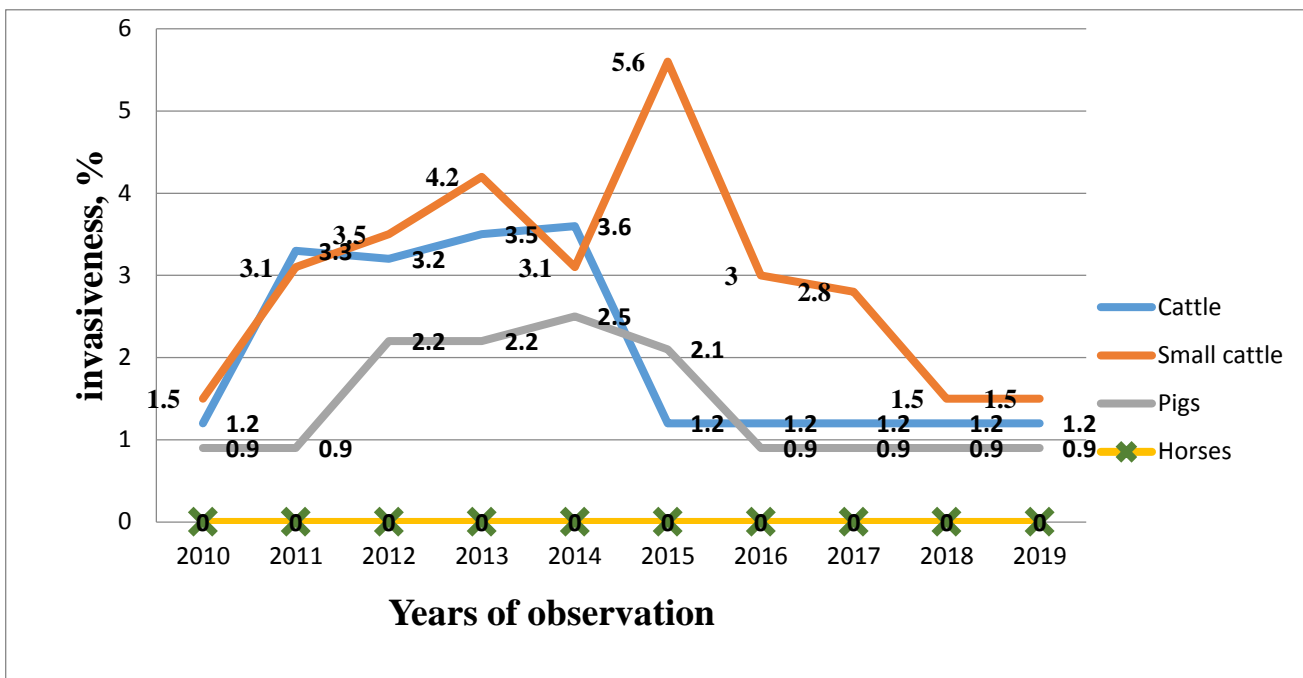


Figure 4. *E. granulosus* invasiveness among farm animals of the Kostanay region (2010-2019).

The creation of specialized stationary slaughterhouses of animals in each district of the region allowed to reduce the rate of echinococcosis infection among farm animals. It is also necessary to control the number of stray dogs by trapping and sterilizing them. We believe that the stock of anthelmintic drugs for the prevention of echinococcosis in districts and cities of the Kostanay region should be increased, and the drugs should be distributed according to the specific epizootic and epidemiological situation for echinococcosis. Between 2000 and 2019 the number of patients with echinococcosis in the Kostanay region amounted to 249 cases. The smallest number of 5 cases was registered in 2000, and the largest- in 2014 and amounted to 26 cases.

In 2002-2015 the incidence rate of echinococcosis in humans did not decrease and ranged from 1.6% to 1.5% per 100.0 thousand people. The lowest incidence rate of people with echinococcosis (0.5%) was recorded in 2000. The maximum number of positive reactions (by ELISA) to echinococcosis was recorded in 2003, 2005, 2006 and from 2013 to 2016, when the incidence rate was 0.9%; 0.8%; 0.26%, 1.8%, 3.0%, 1.5%, 0.9% respectively. The peak incidence of human echinococcosis occurred in 2014 and amounted to 3.0%. Monitoring of the registration of cases of echinococcosis with regards to age groups among people has shown that out of 8 cases in 2016, 3 cases were registered in people under 14, the incidence rate per 100.0 thousand being 1.74%. In 2017, out of 7 cases of registration of echinococcosis among people, 2 cases were in the population under 14, the incidence rate per 100.0 thousand being 1.14%. In 2018, 7 cases of echinococcosis were registered, the incidence rate per 100.0 thousand being 1.13%. Thus, echinococcosis remains a serious social problem and the creation of specialized stationary slaughterhouses for animals in each district of the region has reduced the echinococcosis infection rate among farm animals and people. It is also necessary to control the number of stray dogs by trapping and sterilizing them. We believe that the need for the required amount of anthelmintic drugs for the prevention of echinococcosis in districts and cities of the Kostanay region should be increased, and the drugs should be distributed according to the specific epizootic and epidemiological situation for echinococcosis. The studies were carried out as part of a scientific project: "Scientific support for veterinary well-being and food safety in the Kostanay region."

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