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SPREAD OF TOXOPLASMOSIS IN HUMANS AND ANIMALS IN THE TYUMEN REGION

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Abstract:

The objective of the research was to study the spread of toxoplasmosis in people and animals in the Tyumen region. Studies on the diagnosis of toxoplasmosis in humans were carried out at the Federal Budgetary Institution of Science "Tyumen Scientific and Research Institute of Territorial Infectious Pathology" of Rospotrebnadzor (Tyumen) in 2000-2015. Diagnosis of toxoplasmosis in animals was carried out in the Tyumen Regional Veterinary Laboratory in 2011-2016. The disease incidence among people in the region was analyzed using the results of immunological studies of various age groups of the population. To diagnose toxoplasmosis in animals, parasitological and immunological methods of diagnosis were used. It was established that toxoplasmosis is a widely common disease among people living in the Tyumen region. The maximum number of positive reactions to toxoplasmosis was recorded in 2002, 2003, 2008, and from 2012 to 2016, when the level of seropositive reactions was 26.2; 20.2; 12.26; 17.08; 11.36; and 10.59% of people examined for toxoplasmosis. In 2014, the highest seropositivity rates for T.gondiiwere 250.35 and 151.09 per 100 people, respectively, in Abatsky and Omutinsky districts of the Tyumen region. As for urban residents of the region, toxoplasmosis is common among residents of the regional center, with 32.34 seropositive people per 100 thousand population found in 2012. Among children, the invasion was recorded at the age of over one year with the maximum seropositive level - 4.36% in 2012. Among dogs and cats examined for the presence of antibodies to T.gondii, the maximum level of seropositivity was found in 2013 and 2016. These indicators were at the level of 15.4 and 15.0%, respectively. During the examination of seropositive cats, the release of oocysts of T.gondii was found in only 0.42%.

Keywords: *Toxoplasmosis, seropositivity, Tyumen region, dogs, cats*

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INTRODUCTION:

One of the important problems of medicine and veterinary medicine that has serious socio-economic importance is toxoplasmosis. Special attention to this disease is justified by its consequences, which are most important for a person, and especially to a developing fetus when a pregnant woman is infected during pregnancy.

The widespread occurrence of toxoplasmosis among animals, especially free-living and wild, does not allow for its control and affects more and more susceptible organisms.

For the first time, the causative agent of toxoplasmosis - *Toxoplasma gondii*, was mentioned in 1908 in Tunisia and Brazil in Gundi (a species of rodents) and rabbits, respectively [1,8,16,20]. The first case of congenital toxoplasmosis was diagnosed in 1923 [2,17]. To date, the number of persons infected with toxoplasma exceeds 1.5 billion people, and the prevalence of toxoplasma in different areas varies from 14 to 90%, averaging at least 35% [5,7,10,14]. The minimal prevalence of the population is noted in the Nordic countries - 14%, low, in New Zealand, Great Britain and Australia - 25%, the average level - 35-50% in many countries of Asia, Africa, America, and Europe [5,6,10,11,20]. This is evidenced, in particular, by the fact that a high percentage (60–90%) of individuals with antibodies to toxoplasma [18,20] was detected among the population of several countries in Asia and Western Europe. Annual rates of seroconversion in countries with a high prevalence of the population are more than 3%, in the "toxoplasmosis-safe" countries of Northern Europe and in the "relatively safe" UK and USA, this indicator is less than 1% [2]. But even if looking at the minimum indicator, 0.6% of the US population who annually suffer the acute phase of invasion amount to about 1.5 million cases of the disease, and approximately 15% of them are clinically significant [15]. In different territories of Russia, invasion of the population (according to quite incomplete data) is on average 30-35% [1].

Due to the lack of awareness of the population each year, hundreds of cats are euthanized or thrown into the streets, aggravating the problem of neglected animals. Home-living animals who have never encountered *T. gondii*, risk being infected, as a result of which they become subjects of the excretion of Toxoplasma cysts, infecting children's playgrounds, especially sandboxes, municipal water bodies, and lawns. A vicious circle occurs.

The spread of toxoplasmosis in populated areas is due to the lack of a systematic approach to the regulation of the number of homeless animals.

In 2012-2018 in Tyumen, 9623 dogs were taken from the streets of the city, most of which were returned back without prior examination for toxoplasmosis and no action taken depending on the situation.

Thus, a systematic approach to the problem of toxoplasmosis is required, where human doctors, veterinarians, breeders, and owners of animal nurseries, epidemiological control services, and every person would work to educate the population, early diagnose, prevent the disease, interrupt the development cycle of the pathogen and eliminate it from environment.

Given the significance of the problem and the lack of current knowledge about the distribution of toxoplasmosis in the Tyumen region, we set a goal to study the spread of toxoplasmosis in humans and domestic animals in the Tyumen region.

MATERIALS AND METHODS:

Studies on the diagnosis of toxoplasmosis in humans were carried out at the Federal Budgetary Institution of Science "Tyumen Scientific and Research Institute of Territorial Infectious Pathology" of Rospotrebnadzor (Tyumen) in 2000-2015. Diagnosis of toxoplasmosis in animals was carried out in the Tyumen Regional Veterinary Laboratory in 2011-2016. The disease incidence among people in the region was analyzed using the results of immunological studies of various age groups of the population. To diagnose toxoplasmosis in animals, parasitologicaland immunological methods of diagnosis were used.

The parasitological methods were the microscopy of smears of the affected organs and stool tests. 723 stool tests were conducted. The immune-chromatographicanalysis was performedusing the rapid test system (Quicking Biotech Co., Ltd.); the immunological methods were enzyme immunoassay used to detect IgG and IgM [12,13].

RESULTS:

We established that the epizootological situation of toxoplasmosis among people is constantly changing and the number of seropositive reactions varies from 0 to 26.2% of those examined. Thus, no cases of toxoplasmosis among people were recorded in 2007; this period was preceded by an intense decline in positive results (Figure 1). The maximum number of positive reactions to toxoplasmosis was recorded in 2002, 2003, 2008, and from 2012 to 2016, when the level of seropositive reactions was 26.2; 20.2; 12.26; 17.08; 11.36; and 10.59% of people examined for toxoplasmosis.

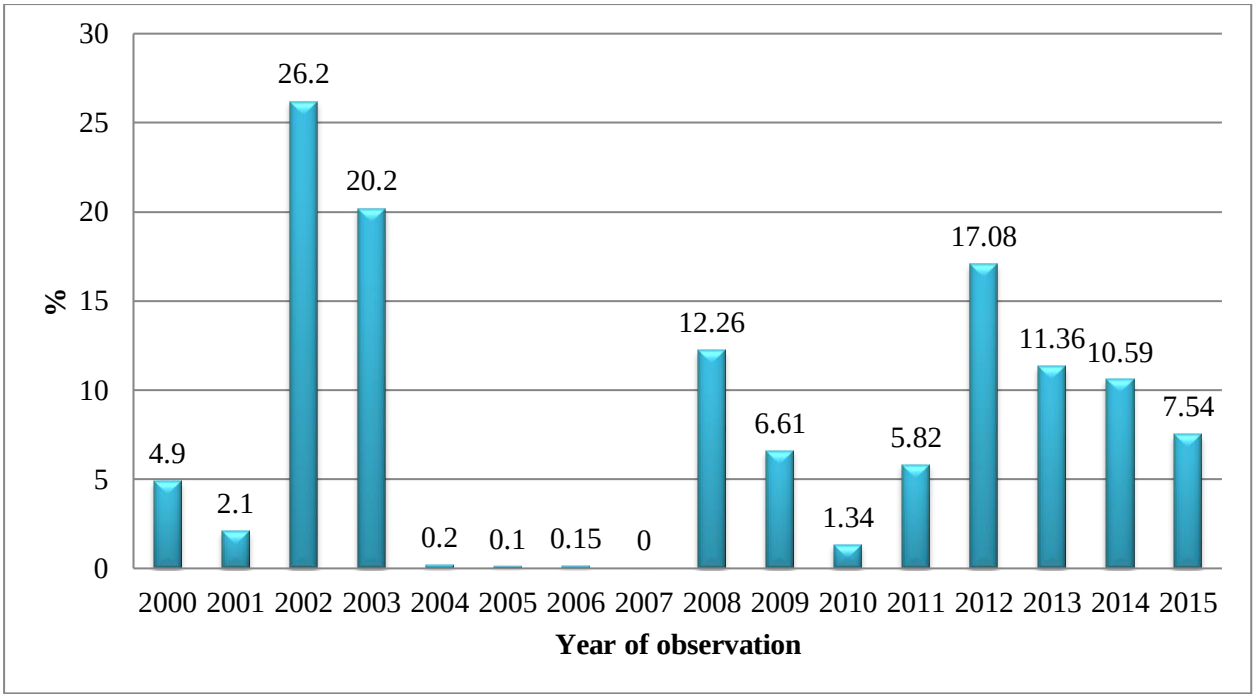

Figure 1. The level of the infected population of the Tyumen region, share, % (2000-2015)

The frequency of detection of antibodies to *T.gondii* varied depending on the residential area of the population. The population of Abatsky and Omutinsky districts turned out to be the most infected. In 2014, the rate of infection of the population with toxoplasmosis per 100 thousand people reached its maximum of 250.35 and 151.09, respectively. In 2015, the situation remained virtually unchanged and the level of invasion in the same areas was 229.4 and 137.5. At the same time, in the neighboring areas, the infection rate was significantly lower and ranged from 0 to 27.38.

The situation of *T.gondii* invasion among urban residents of the Tyumen region has also been clarified. The results of research in the cities of Tyumen, Ishim, and Tobolsk were analyzed. Residents of the regional center were found to be the most infected population, while the maximum number of seropositive people in 2012 was 32.34 per 100 thousand population. In other cities, the level of the seropositive population did not exceed 4.18.

Moreover, in 2006-2015, the *T.gondii* invasion rate was studied among children aged 0 to 17 years. It was revealed that only one child under 1 year had antibodies to the specified pathogen.

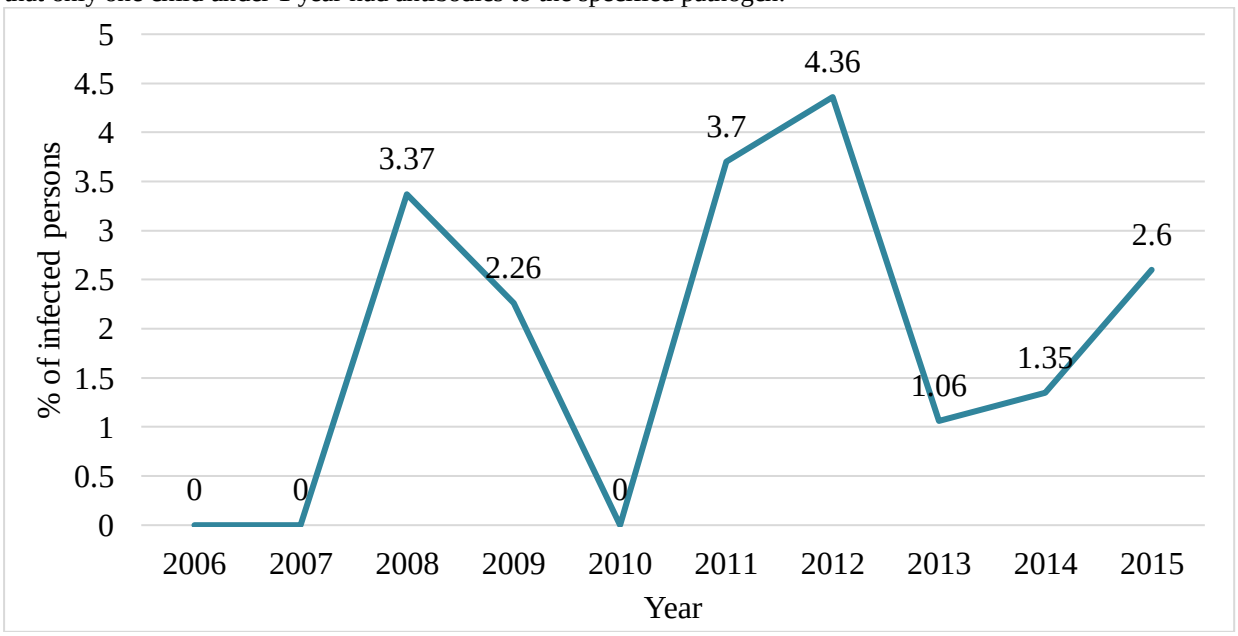

Figure 2. The *T.gondii* invasion rate among children aged 0-17 years in the Tyumen region (2006-2015)

The peaks of the invasion were in 2008, 2011, and 2012, when the detection rate of antibodies to *T.gondii* was 3.37; 3.7; and 4.36%. We should note that the level of seropositive children under 14 is higher. In 2008 it was 4.31, in 2011 - 3.96, and the maximum indicator among children was found in 2012 - 5.13.

Considering that animals are the main spreaders of invasion, we found out the prevalence of toxoplasmosis in domestic animals. It was found that in five studies (2012-2016) the level of seropositive animals varied (Figure 3). Thus, in 2012 and 2015, the level of seropositivity among dogs and cats was 3.4 and 4.0%, respectively. Whereas in 2013 and 2016 these indicators were 15.4 and 15.0%, respectively.

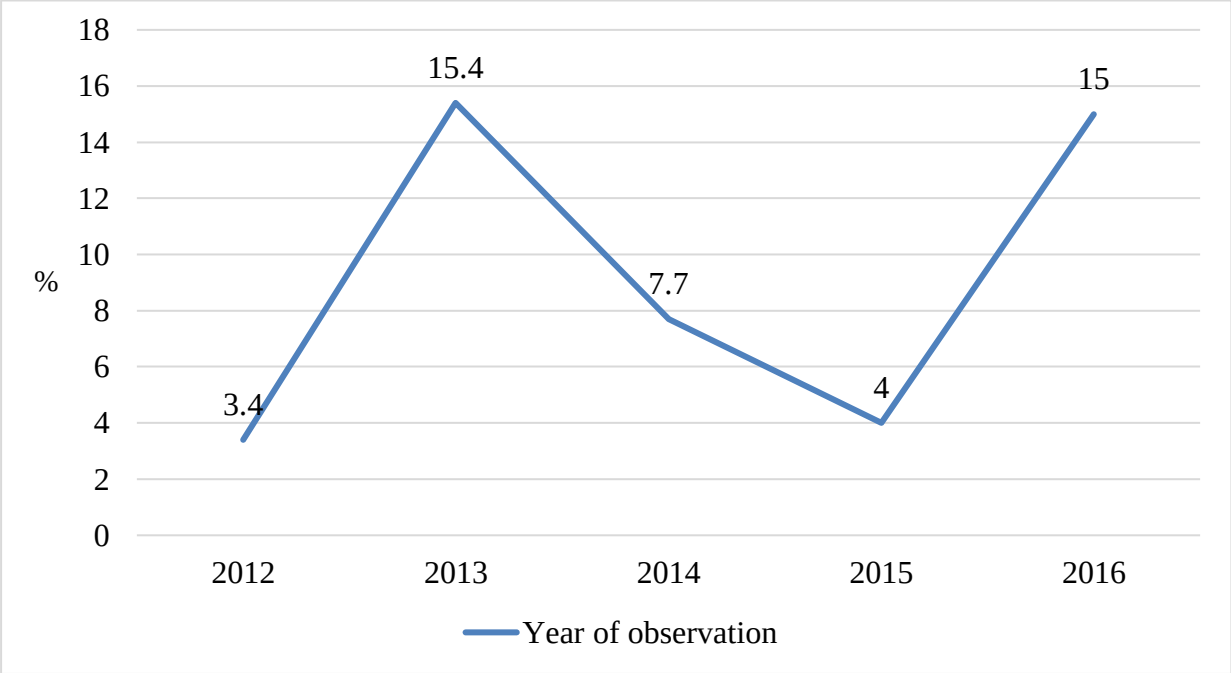

Figure 3. The share of *T.gondii* seropositive dogs and cats in the Tyumen region (2012-2016)

In parallel with the immunological method of diagnosis, 723 stool test of cats were conducted to detect oocysts of toxoplasma (Figure 4). We found that *T.gondii* oocysts are extremely rare in seropositive cats. In 2013-2015, only three samples contained *T.gondii* oocysts.

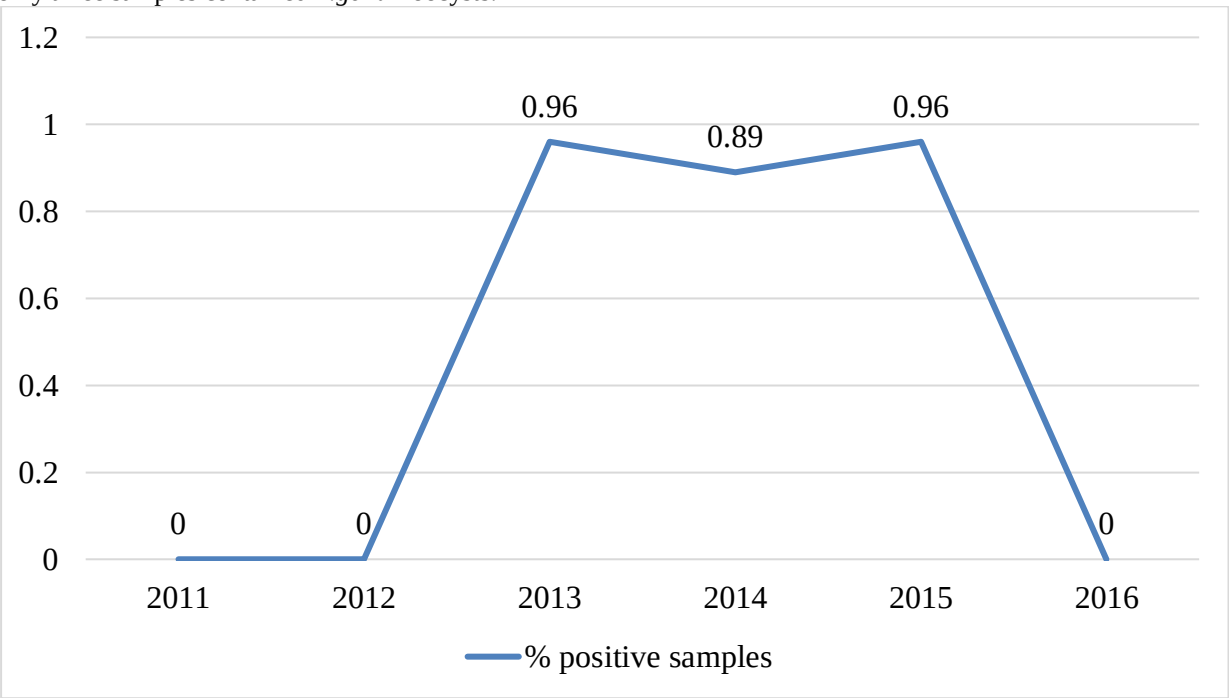

Figure 4. Oocysts in *T.gondii* seropositive cats (2011-2016)

DISCUSSION:

It is considered that 25-30% of the world's population is infected with *T.gondii* [18]. The level of the seropositive population in the Tyumen region is within the average statistical indicators for Russia. Thus, in the Russian Federation, 25% of the population surveyed in Moscow and 32% of the population surveyed in the Oryol region are seropositive to T.gondii [1]. In Krasnoyarsk Krai, 28.6% were seropositive [1]; the level of seropositivity among the surveyed pregnant women in the Belgorod region was 23.6±1.4% [1]. The results of immunological studies among people from the neighboring Omsk region, where the growth of toxoplasmosis was 2.0 times higher in 1992-2006, coincide. The Tyumen region also had the highest rates in 2002 and 2003 - 26.2 and 20.2%, respectively, while in 2004-2007 there was the lowest seropositivity recorded - 0-0.2% [1].

There is evidence that the level of seropositivity to *T.gondii* depends on the socio-economic situation. Thus, the study of the epidemiological situation in Brazil found that antibodies against toxoplasma are found in 84, 62, and 23% of the population of the low, medium, and high class, respectively [18,19]. In the Russian Federation, 83.5% of the children surveyed in the Omsk region, who were seropositive for toxoplasmosis, were from single-parent large families with poor sanitary and living conditions [11]. The highest prevalence of toxoplasmosis (41.0%) was observed in children from rural areas on the background of tuberculosis infection.

Our results also confirm the assumption of the significance of social status and culture on the risk of T.gondii invasion. In the Tyumen region, the population living in rural areas is more seropositive, which may be due to the sanitary and hygiene offenses, as well as a large number of homeless and free-living cats in the private sector. Considering the low level of release of *T.gondii* oocysts from seropositive domestic animals (0.42%), the probability of invasion of people eating semi-raw meat is also high [3,4,6,8,14].

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CONCLUSION:

Analysis of the results allows us to conclude that toxoplasmosis is widespread among people living in the Tyumen region. The maximum number of positive reactions to toxoplasmosis was recorded in 2002, 2003, 2008, and from 2012 to 2016, when the level of seropositive reactions was 26.2; 20.2; 12.26; 17.08; 11.36; and 10.59% of people examined for toxoplasmosis. In 2014, the highest seropositivity rates for *T.gondii*were 250.35 and 151.09 per 100 people, respectively, in Abatsky and Omutinsky districts of the Tyumen region. As for urban residents of the region, toxoplasmosis is common among residents of the regional center, with 32.34 seropositive people per 100 thousand population found in 2012. Among children, the invasion was recorded at the age of over one year with the maximum seropositive level - 4.36% in 2012. Among dogs and cats examined for the presence of antibodies to *T.gondii*, the maximum level of seropositivity was found in 2013 and 2016. These indicators were at the level of 15.4 and 15.0%, respectively. During the examination of seropositive cats, the release of oocysts of *T.gondii* was found in only 0.42%.

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