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Identification of antibodies against *Toxocara canis* among the members of community X

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The study aimed to determine the prevalence of toxocariasis among the members of community X with and without dogs and its association with lifestyle factors. The sample size was 88 individuals: 44 who owned dogs and 44 who did not. The ages of the subjects ranged from 18 to 72 years. The prevalence of toxocariasis in community X was 12.5%, with 11 of the 88 individuals having IgG antibodies against *Toxocara canis*. Factors such as outdoor and indoor dog ownership were statistically significantly associated with the prevalence of toxocariasis ($p < 0.05$). The prevalence of toxocariasis was observed in different age groups. The youngest person to have antibodies against toxocariasis was 20 years old, while the oldest was 68 years old. The highest percentage of infected people was observed in the age group of 62–72 years.

Keywords: *Toxocara canis*, antibodies, lifestyle habits

INTRODUCTION

According to the European Centre for Disease Prevention and Control (2023), dogs of all ages are most commonly infected with several types of helminths: nematodes and cestodes. Very young pets are the most vulnerable. In fact, puppies as young as 2–3 weeks old can have a large number of worms. This is because the mother often passes these worms to the puppies before they are born. They are sometimes transmitted through the mother's milk shortly after the puppies are born. Dogs or cats infected with these worms contaminate the area by carrying the eggs or larvae of the worms in their faeces. A dog can become infected by ingesting dirt contaminated with dog or cat faeces that contain worm eggs or larvae.

The main causative agents of roundworms are *Toxocara canis* and *Toxascaris leonina*, *Ancylostoma caninum*, *Trichuris vulpis*, *Uncinaria stenocephala*, and of flatworms – *Echinococcus*, *Taenia*, *Dipylidium caninum*. Abou-El-Naga and Mogahed (2023) indicate that the intestinal nematode *T. canis* is the most common in dogs. According to these authors, *T. canis* parasites are of the greatest interest regarding their effects on both pet and human health.

According to Magnval et al. (2022), human toxocariasis is a worldwide zoonotic helminthiasis caused by *T. canis* larvae. The adult forms of these ascarid helminths parasitise the bodies of dogs and live in the upper digestive tract of the definitive hosts. The faecal eggs must be in the soil before they mature and become infective. The National Public Health Centre under the Ministry of Health (2022) describes that helminth has through several stages in its development: adult

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helminth, egg, and larva. An adult parasite can reach a length of 4–10 cm. It lives in the small intestine or the stomach of a dog for about 4–6 months. A female infected with *T. canis* releases 200,000 eggs per day. Scoops with pet faeces fall into the folder but are still immature. In addition, the National Public Health Centre under the Ministry of Health (2022) states that toxocara eggs are constantly polluting the soil throughout the year, but they start developing in the soil when the ambient temperature rises to 10°C. The optimal conditions for development are 24°C to 30°C, air humidity 85%, and soil humidity above 20%.

Human infection with *Toxocara* spp. larvae causes various syndromes, but most cases are likely to be asymptomatic. According to the type of damage, toxocariasis can be divided into visceral, asymptomatic (secret), neurological, and ocular (Chen et al., 2018).

The clinical pathology of toxocariasis is highly dependent on the form of infection, intensity of infection, larval localisation, and the age of the host (Magnaval et al., 2022). According to Jasim and Hadi (2021), visceral toxocariasis most commonly affects young children (aged around 5 years). The disease is characterised by fever, splenomegaly, liver enlargement and necrosis, lower respiratory tract symptoms (especially asthma-like bronchospasm), eosinophilia, and hypergammaglobulinemia of the immunoglobulin M (IgM), IgG, and IgE classes. Myocarditis, nephritis, and damage to the central nervous system may also occur. CNS lesions may cause seizures or encephalopathy. The majority of infections are asymptomatic or latent, so the patient's illness may not be detected. This research aimed to determine the prevalence of toxocariasis in members of community X with and without dogs and its association with lifestyle factors.

MATERIALS AND METHODS

An invitation to participate in the study was distributed on the website of community X. Community X is people working in a certain institution. The investigation was conducted in April 2023. The place of residence of the community members was not taken into account. Two groups of dog owners were distinguished. Dogs that were kept both inside and outside in the warm season were assigned to the group 'indoor and outdoor keeping'. Dogs that were kept only at home, taken out for walks, but spent most of their time at home were assigned to the group 'inside keeping'. None of the participants chose the group where the dogs were kept outdoors at all times. Blood samples were collected into 5.0 mL serum vacuum tubes. Blood samples were centrifuged at 3300 rpm/min for 7 min, and the obtained serum was separated into 2.0 ml tubes and stored at –20°C.

Serum samples were tested for IgG antibodies by Human Anti-Toxocara canis IgG ELISA Kit (Demeditec Diagnostics, Germany). Before assay, all samples were diluted 1+100 with sample dilution. Polystyrene 96-well microplates were coated for 1 h at 37°C followed by a 30 min incubation at room temperature. The absorbance of all wells at 450 nm was measured and the absorbance values for each standard/control were recorded. A serum sample was considered positive when its reactivity index was greater than 11 U. Data was analysed using descriptive tests, and one-way ANOVA at the level of 0.05, and IBM SPSS Statistics 26 software.

RESULTS AND DISCUSSION

In this study, toxocariasis infection was found in various age groups (Fig. 1). Percentagewise, the highest incidence was in the age group of 62–72 years (33.3%). Antibodies against *T. canis* were not detected at all in the age group of 29–39 years, as well as a small proportion of infected people in the age group of 18–28 years. The number of infections was similar between age groups of 40–50 years (17.2%) and 51–61 years (14.3%). The youngest subject with IgG antibodies against toxocariasis was 20 years old, and the oldest was 68 years old. No statistically significant association was found between the variables ($p > 0.05$). Toxocariasis infection is especially common in subtropical and tropical regions and the developing countries.

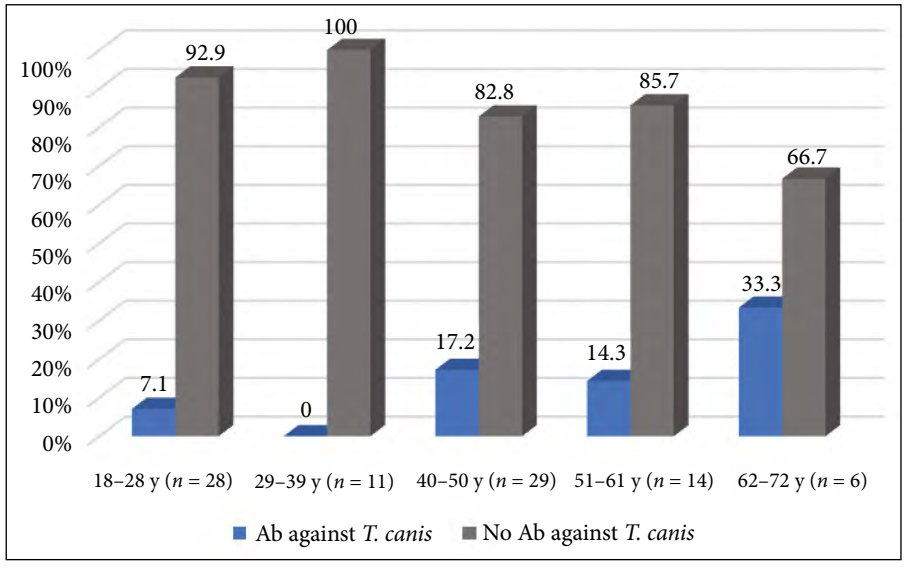

Fig. 1. Age-related serum antibodies against *Toxocara canis*

Phasuk and Phunsawad (2020) emphasised in their study that in some countries of the world, seroprevalence is extremely high. For example, in Nigeria the percentage of antibodies against *T. canis* in the population reached 86.1%, in Marshall Islands 86.75%, and in northeastern Brasil 63.6%. Toxocariasis is widely distribution in Asia: 17–46% in Taiwan, 45.9% in Turkey, 49% in the Philippines, 51.2% in South Korea, and 23.5–45.9% in Iran. Prevalence in Western countries is 5% in the USA, 8% in Italy, and 16% in Greece.

Of the 44 subjects who had dogs, the majority (95.5%) answered that they kept the dog at home (Fig. 2). None of the respondents indicated that the dog was kept outside. The highest rate of toxocariasis infection was observed among the respondents who kept their dogs both at home and outside (58.3%). A statistical relationship was found between these variables

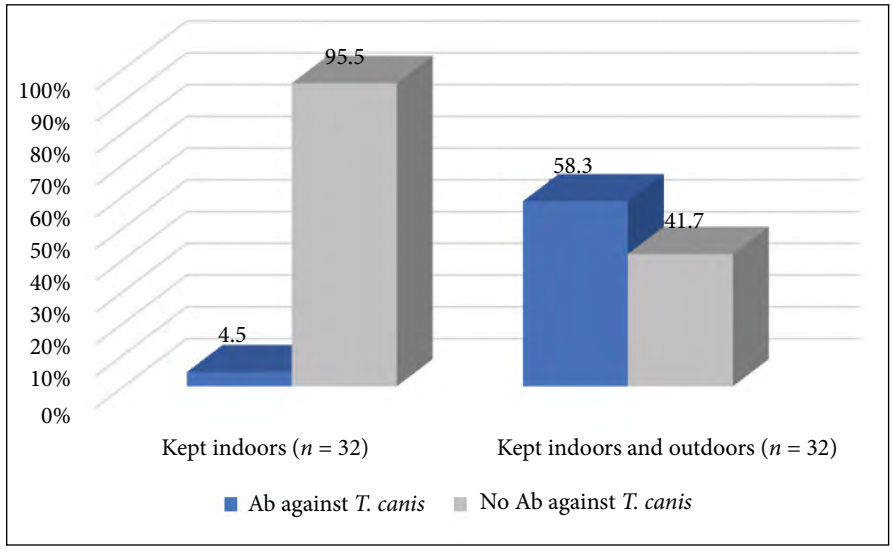

Fig. 2. Immunoglobulins against *Toxocara canis* among holders of dogs that were kept at home and outside and home

at $p < 0.05$ ($p = 0.011$). Daily activities such as feeding, petting, playing with pets, and and the pets friendly licking the owners increase the risk of parasites entering the human body (Wulan, 2023). Moreover, Nguyen et al. (2021) emphasised that although most zoonotic infections in dogs are transmitted within the household, dog faeces in public areas such as parks, children's playgrounds, and beaches can be a potential source of viable zoonotic parasites for the community.

A study conducted by Panova and Khrustalev in 2018 indicates the possibility of dogs' outdoor walks on *Toxocara* spp. for eggs to enter the house. The amount of helminth eggs was determined by washing the paws of dogs after a walk, from their owners' shoes, and from the shoes of people who did not keep dogs. The results showed that *Toxocara* spp. eggs were detected in 19.4% of dog paw washes and 11.4% in washes from their owners' shoes. There were about twice as many eggs found on the paws than on the shoes. No parasite eggs were found in the shoe polish of people who did not own dogs. Even when animals are not infected with a pathogenic infection, they can participate in the spread of the infection causing the risk of toxocariasis in humans. Thus, *T. canis* eggs become agents of persistent, cumulative subclinical infections with delayed onset. The contamination of paws with eggs is believed to be one of the main ways to spread toxocariasis (Panova, Khrustalev, 2018).

The greatest risk of infection in children is due to the lack of proper hygiene skills; the second most dangerous period is old age because the immune system weakens and the contact with parasitosis agents is the longest and most varied. Pets excrete large numbers of eggs, and these eggs can quickly infect a considerable area. Worm eggs and larvae can survive for weeks and even years in places such as parks, playgrounds, and yards (Centre for Disease Control and Prevention, 2021). *T. canis* eggs can be transmitted by flies and other insects by drinking contaminated water, by eating insufficiently heat-treated meat products (poultry, veal, lamb liver, lungs, etc.), which may also contain hypobiosis toxocara larvae (Mickienė et al., 2012). The weakening of the body's immune system as a result of age also creates easier conditions for helminth infection.

CONCLUSIONS

Antibodies against *T. canis* were found in all age groups, but the majority of subjects with antibodies were in the 51–61 age group. This confirms the hypothesis that immunity weakens with age and there is a greater chance of contact with *T. canis* over time. The conditions of keeping the pet also influence the spread of infection: if a dog is kept both indoors and outdoors, the probability of infection increases.

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ANTIKŪNŲ PRIEŠ *TOXOCARA CANIS* NUSTATYMAS TARP X BENDRUOMENĖS NARIŲ

Santrauka

Tyrimo tikslas – nustatyti toksokarozės paplitimą tarp X bendruomenės narių, laikančių ir nelaikančių šunų bei sąsajas su gyvenimo būdo veiksniais. Imties dydis buvo 88 asmenys: 44 laikantys ir 44 nelaikantys šunų. Tiriamųjų amžius svyravo nuo 18 iki 72 metų. Toksokarozės paplitimas bendruomenėje X buvo 12,5 %, t. y. 11 iš 88 asmenų turėjo IgG antikūnų prieš *Toxocara canis*. Tokie veiksniai kaip šunų laikymas lauke ir patalpoje buvo statistiškai reikšmingai susiję su toksokarozės paplitimu ($p < 0,05$). Toksokarozė buvo nustatyta skirtingose amžiaus grupėse: jauniausias žmogus, turintis antikūnų prieš toksokarozę, buvo 20 metų, o vyriausias – 68 metų. Didžiausias užsikrėtusiųjų procentas buvo 62–72 metų amžiaus grupėje.

Raktažodžiai: *Toxocara canis*, antikūnai, gyvenimo būdo įpročiai