

EPIDEMIOLOGICAL RELATIONSHIP BETWEEN HUMAN TOXOPLASMA INFECTION AND CATS IN BELGRADE

B. BOBIĆ, OLGICA DJURKOVIĆ-DJAKOVIĆ, DESANKA ŠIBALIĆ, IVANA JEVREMOVIĆ*, JELENA MARINKOVIĆ**, ALEKSANDRA NIKOLIĆ* and DRAGANA VUKOVIĆ

*Institute for Medical Research, *Institute of Epidemiology, School of Medicine, University of Belgrade, **Institute of Social Medicine, Statistics and Health Research, School of Medicine, University of Belgrade, 11000 Belgrade, Yugoslavia*

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*Toxoplasmosis is one of the most widely spread anthroponoses in the world. Being the definitive host of the heteroxenous coccidian parasite *Toxoplasma gondii*, the cat is the source of infection. The cat may present a source of human infection both via direct contact and indirectly, via exposure to environmental contamination (excretion of oocysts into the soil). To assess the epidemiological relationship between human toxoplasma infection and the cat in Belgrade as a model urban environment, we performed an epidemiological study involving 1157 women of reproductive age residing in Belgrade during a four-year period (1988-1991). The rate of infection increased with age, ranging from 57% to 93%, with an overall mean of 77%. Exposure to soil (farming, gardening) was shown to contribute significantly to infection in the group of women below 20 years of age, indicating that cats are an epidemiologically significant source of environmental contamination in Belgrade. On the other hand, cat ownership as a criterion of contact with cats was not shown to contribute significantly to infection in the examined population.*

Key words: human toxoplasmosis, cats, epidemiology

INTRODUCTION

Toxoplasma gondii, an obligatory intracellular coccidian parasite, is ubiquitous in nature, found in over 200 species of mammals, including man, and 65 bird species, as well as in some species of poikilothermic animals (Johnson, 1989). The life cycle of the organism includes schizogony, gametogony and sporogony, of which gametogony occurs exclusively in members of the *Felidae* family, while schizogony occurs in all other, therefore intermediate, hosts. Namely, following infection, resulting generally from ingestion of bradyzoite cysts, asexual reproduction in intermediate hosts leads to the proliferation of tachyzoites which are eventually transformed into bradyzoites. However, in the intestinal epithelium of an infected cat the parasites undergo transformation into

micro and macrogametes. Gamete fusion produces a zygote, which surrounds itself by a rigid multilayer membrane thus forming an uninfected unsporulated oocyst. Oocysts are excreted into the environment 7-20 days post infection. Within 1-4 days in the soil, sporulation occurs under ambient conditions (oxygenation, humidity, temperature), giving rise to now highly infectious oocysts containing four sporozoites. Oocysts retain their infectivity in the soil over a prolonged period of time (Frenkel et al., 1970; Dubey et al., 1970; Hutchison et al., 1971).

Cats shedding oocysts are therefore the main source of environmental contamination. In addition, contact with cats may present a route of direct transmission of human toxoplasma infection, through accidental ingestion of oocysts when handling cat feces. In contrast, touching an acutely infected cat does not present an infection risk as feces does not stick to the fur of the perianal region (Dubey, 1994). Because of the widespread presence of both pet and stray cats in urban environments, we carried out an investigation of the significance of the cat in the epidemiology of human toxoplasma infection in Belgrade as a model urban environment. The role of the cat as a source of environmental contamination was assessed indirectly, by defining the role of exposure to soil (contaminated exclusively by oocysts excreted by cats). Individuals owning cats as house pets were considered to be in contact with cats.

MATERIAL AND METHODS

This study involved 1157 Belgrade-residing women tested for toxoplasma infection at the Toxoplasmosis Research Laboratory, Institute for Medical Research, during the period from January 1, 1988 to December 31, 1991. The age range of the women involved was 15-45 years.

Toxoplasma infection was determined by the finding of toxoplasma antibodies by Desmonts's modification of the classical gold-standard Sabin-Feldman test (1955). Epidemiological data were collected by means of a questionnaire which included questions about age, cat ownership and exposure to soil (farming, gardening).

The significance of the differences in the distribution of particular variables (contact with cats, exposure to soil) between the groups of infected and uninfected women was statistically evaluated by the chi square test. Further statistical evaluation of the relationship between toxoplasma infection and the tested variables was carried out by logistic regression, using the forward stepwise Wald method. For both tests, the level of statistical significance was a probability below 5%.

RESULTS AND DISCUSSION

The overall rate of toxoplasma infection in the examined population amounted to 77.4%, placing the Belgrade area at the top of the prevalence list in

Europe. Namely, the formerly highest infection rate in Europe - 83% - reported for Paris in 1965 (Desmonts et al.), has apparently decreased to 71% (Jeannel et al., 1988). Worldwide, the prevalence of infection varies within a wide range from 2% in Northern Norway (Stray-Pedersen et al., 1979) to above 90% in Salvador (Remington et al., 1970). The prevalence of infection increased with age, within a range from 57.1% in the 15-19-year age group to 92.6% in the group of women above 40 (Figure 1).

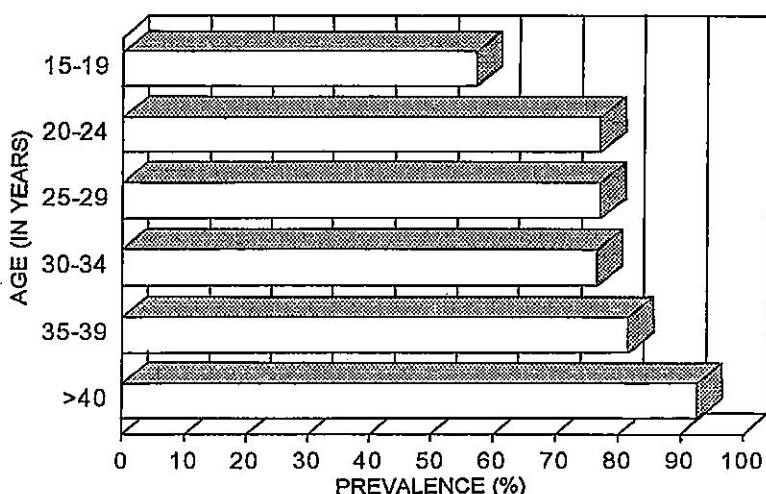


Figure 1. Rates of toxoplasma infection according to age in the group of 1157 women as obtained by serology

A summary of epidemiological data is presented in Table 1. Of all 1157 women tested, 209 (18.1%) confirmed exposure to soil while 948 denied it. Both the infected and uninfected women were evenly exposed to soil ($X^2=1.263$, $p=0.261$). This finding indicated that exposure to soil did not significantly contribute to infection and was further confirmed by regression analysis of the data obtained for the whole group ($p=0.399$). However, analysis of the data stratified by five-year age intervals showed that the rate of infection was significantly higher in the youngest age group (15-19 years) of women exposed to soil ($p=0.037$, relative risk 1.385 within a 95%-confidence interval of 1.12 - 1.967).

Table 1. Epidemiological data in the group of 1157 women serologically tested for toxoplasma infection

Women examined	Exposure to soil		Contact with cats	
	yes	no	yes	no
Infected	168	728	242	654
Uninfected	41	220	78	183
Total	209	948	320	837

Following infection, the parasite persists in the encysted form presumably throughout the lifetime of its host. This fact can help explain our result that contact with soil contributes to infection in the youngest age group, suggesting that these individuals become infected at an early age. Obviously, other transmission routes gain significance with age. The finding that exposure to soil presents a significant infection risk implies a high level of soil contamination, which, in turn, implies a high cat infection rate. A twenty-year-old study indicates that the prevalence of infection in cats in our milieu is about 25% (Šibalić, 1977). As cats generally defecate into loose soil, vegetable and flower gardens which are regularly tilled are probably the most contaminated, and therefore, epidemiologically the most significant.

Owning a cat as a household pet was confirmed by 320 (27.7%) of the 1157 women involved. There was no significant difference in the exposure to contact with cats between the infected and uninfected women ($\chi^2=0.853$, $p=0.653$). That contact with cats was not a factor which significantly contributed to infection, either in the group as a whole or in any of the age groups, was further confirmed by regression analysis ($p=0.327$). Although earlier investigations did show a correlation between the prevalence of infection and close contact with cats (Peterson et al., 1972; Jindrichova et al., 1975; Frenkel et al., 1980), our result is consistent with the newer findings of Jackson et al. (1987), DiGiacomo et al. (1990) and Wallace et al. (1993). As infection can only result from exposure to feces excreted more than 24h previously, the possibility of infection is negligible if feces is disposed of on a daily basis and if its disposal is performed in gloves and care is taken of hand, clothing and milieu hygiene. Although in the examined population contact with cats has not been shown to present a significant transmission risk, infection cannot be excluded in individual cases associated with a low level of hygiene.

A c k n o w l e d g e m e n t.

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ULOGA MAČKE U EPIDEMIOLOGIJI HUMANE TOKSOPLAZMATSKE INFEKCIJE U BEOGRADU

B. BOBIĆ, OLGICA ĐURKOVIĆ-ĐAKOVIĆ, DESANKA ŠIBALIĆ, IVANA JEVREMOVIĆ, JELENA MARINKOVIĆ, ALEKSANDRA NIKOLIĆ I DRAGANA VUKOVIĆ

SADRŽAJ

Toksoplazmoza je jedna od najrasprostranjenijih antropozoonoza u svetu. Mačka kao stalni domaćin heteroksene kokcidije *Toxoplasma gondii* je izvor infekcije ovim parazitom, a do širenja infekcije može doći direktnim kontaktom ili indirektno preko zemljišta kontaminiranog oocistama iz mačjeg fecesa.

Cilj rada je bio da se ispita uloga mačke kao izvora infekcije, i kontakta sa mačkom kao direktnog puta širenja toksoplazmatske infekcije u Beogradu kao modelu urbane sredine. Epidemiološkim ispitivanjem je obuhvaćeno 1157 žena generativne dobi iz Beograda u periodu 1988-1991. godina. U ispitivanoj grupi stopa inficiranosti je iznosila 77%, a rasla je sa uzrastom ispitanica u rasponu od 57% u grupi žena od 15 do 19 godina do 93% u grupi žena iznad 40 godina starosti.

Izloženost kontaktu sa zemljom u ispitivanoj grupi značajno je doprinosila nastanku infekcije samo u grupi žena mlađih od 20 godina. Ovaj rezultat ukazuje na visok nivo kontaminacije zemljišta oocistama *T. gondii*, a time i na epidemiološki značaj mačke kao jedinog izvora kontaminacije sredine. Takođe pokazuje da se, pošto jednom inficirana osoba ostaje doživotno inficirana, osobe izložene kontaktu sa zemljom inficiraju već u ranoj životnoj dobi.

Za kontakt sa mačkama nije pokazano da nosi rizik od nastanka infekcije u ispitivanoj populaciji što ukazuje na dovoljno visok nivo higijene osoba kojima je mačka kućni ljubimac.