

# *Toxocara* Seroprevalence in Schizophrenic Patients in Turkey

Mustafa Kaplan,<sup>1</sup> Ahmet Kalkan,<sup>2</sup> Salih Kuk,<sup>1</sup> Kutbeddin Demirdag,<sup>2</sup> Mehmet Ozden,<sup>2</sup> and S. Sirmil Kilic<sup>2</sup>

Firat University Faculty of Medicine, Departments of <sup>1</sup>Medical Parasitology, <sup>2</sup>Infectious Disease and Clinical Microbiology, TR23119 Elazig, Turkey.

**Purpose:** To investigate the seroprevalence of toxocariasis in patients diagnosed as schizophrenia. **Patients and Methods:** Ninety-eight schizophrenic patients hospitalized at The Elazig Psychiatric Hospital were included in the study. Anti-*Toxocara* IgG and/or IgM antibodies were determined by using commercial *Toxocara canis* IgG and/or IgM ELISA kit. **Results:** Seropositivity for *T. canis* was detected in 45 (45.9%) of 98 patients and 2 (2.0%) of 100 control subjects the difference was statistically significant ( $p < 0.001$ ). The seroprevalence was 40.4% (19 cases) and 51.0% (26 cases) for female and male subjects, respectively ( $p = 0.3$ ). When the seropositive and seronegative schizophrenic patients were compared with respect to the age group environment they were living in, occupation period of follow up and number of hospitalizations, there were no differences between the two groups (all,  $p > 0.05$ ). **Conclusion:** In conclusion, the schizophrenic state seems to present a high risk for *Toxocara* infection in Turkey.

**Key Words:** Toxocariasis, seroprevalence, schizophrenic patients

## INTRODUCTION

Toxocariasis is a disease caused by *Toxocara canis* and *T. cati*, whose host, dogs and cats, respectively, excrete eggs in their faeces. After 1 - 3 weeks the eggs become embryonated and infectious. Humans become infected by oral ingestion of infectious eggs. The eggs hatch out in the intestine and larvae penetrate the wall and migrate to the liver and lungs. In the process body circulation organisms spread to various tissues and cause at

least three syndromes in humans: visceral larva migrans syndrome, ocular larva migrans syndrome, and covert toxocariasis.<sup>1-3</sup>

A high seroprevalence of *Toxocara* infection has been found in developing countries where the climate is humid, which is appropriate for egg survival in soil.<sup>3-6</sup> Human toxocariasis is common where the dog population is large but the state of hygiene is low. The highly infected population includes children, dog owners, people living in rural areas and people with pica syndrome.<sup>7-9</sup> A high correlations between the style of life and *Toxocara* infection risk has been demonstrated. In addition, *Toxocara* infection may be increased in mentally retarded patients when adequate personal hygiene is not practised.<sup>7,10-12</sup> Schizophrenic patients typically have poor hygiene and self-care skills. The literature about toxocariasis epidemiology in psychiatric patients is very sparse. In the present study, our aim was to investigate the seroprevalence of toxocariasis among schizophrenic patients and compare them with a healthy population in Turkey.

## PATIENTS AND METHODS

### Study area

The Elazig Psychiatric Hospital in which we performed this study is a regional mental hospital, one of the biggest and oldest, serving 18 surrounding provinces in Eastern Anatolian of Turkey. The hospital had a 400-bed capacity and 5200 m<sup>2</sup> garden for the remission period of the patients.

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Reprint address: requests to Dr. Mustafa Kaplan, Department of Medical Parasitology, Firat University, Faculty of Medicine, TR-23119 Elazig, Turkey. Tel: 90424 2333555/1556, Fax: 90424 2379138, E-mail: mkaplan101@yahoo.com

### Schizophrenic patients and control group

Ninety-eight schizophrenic patients were included in this study, who had been diagnosed according to the Diagnostic and Statistical Manual of Mental Disorders-IV criteria and hospitalized at Elazig Psychiatric Hospital. The patients' sera were collected when they were hospitalized. This study was performed according to the protocol approved by the Firat University Medical School's

Ethics Committee and was permitted by from the authorities of Elazig Psychiatric Hospital. Since the majority (n = 93) of the patients were in the remission period of their disorder, the consent was directly obtained from them. For the other 5 patients, the consent was obtained from their relatives (n = 3) and legal guardians (n = 2). The data concerning the age, sex, environment conditions (rural or urban), profession, pet ownership, number of hospitalizations and follow-up periods

**Table 1.** Characteristics of Schizophrenic Patients

	Total	<i>Toxocara canis</i>		Statistics	
		Seronegative (%)	Seropositive (%)	$\chi^2$	<i>p</i> value
Sex					
Female	47	28 (59.6)	19 (40.4)	1.097	0.295
Male	51	25 (49.0)	26 (51.0)		
Age groups* (yrs)				4.673	0.322
20 - 29	19	12 (63.2)	7 (36.8)		
30 - 39	38	23 (60.5)	15 (39.5)		
40 - 49	21	9 (42.9)	12 (57.1)		
50 - 59	15	8 (53.3)	7 (46.7)		
≥ 60	5	1 (20.0)	4 (80.0)		
Profession				0.779	0.692
None	34	43 (81.1)	38 (84.4)		
Farmer	13	7 (53.8)	6 (46.2)		
Other <sup>‡</sup>	4	3 (75.0)	1 (25.0)		
Living environment				0.416	0.519
Rural	60	34 (56.7)	26 (43.3)		
Urban	38	19 (50.0)	19 (50.0)		
Pet ownership				0.009	0.604 <sup>†</sup>
No	89	48 (53.9)	41 (46.1)		
Yes	9	5 (55.6)	4 (44.4)		
Follow up duration (yrs)				4.268	0.371
1 - 5	47	25 (53.2)	22 (46.8)		
6 - 10	26	16 (61.5)	10 (38.5)		
11 - 15	13	4 (30.8)	9 (69.2)		
16 - 20	9	6 (66.7)	3 (33.3)		
≥ 21	3	2 (66.7)	1 (33.3)		
Number of hospitalization				2.416	0.491
1 - 2	50	28 (56.0)	22 (44.0)		
3 - 4	24	10 (41.7)	14 (58.3)		
5 - 6	12	7 (58.3)	5 (41.7)		
≥ 7	12	8 (66.7)	4 (33.3)		

\*Three 18-19 years old persons were included in the 20-29 years old age group.

<sup>†</sup>Fisher's Exact Test.

<sup>‡</sup>Include civil servant, worker (no soil-related), business man etc.

were obtained from the 93 patients themselves and their medical records and from the relatives and legal guardians of the remaining 5 patients. Data are presented in Table 1.

The control group was composed of healthy subjects who had similar socio-economic and environmental conditions with the schizophrenic patients (except the hospital condition and follow up duration). In addition, the controls did not have a history of major mood disorder, schizophrenia, and psychotic disorders, dementia, mental retardation or psychosis in their first-degree relatives. There were 100 volunteers (50 males and 50 females) aged 18 - 60 ( $35 \pm 8$  year) in the control group (Table 2).

### Serological evaluation

Blood samples (5 mL) were collected and separated serum samples were stored at  $-20^{\circ}\text{C}$  until

used. Anti-*Toxocara* IgG and/or M antibodies were investigated in all cases by using a commercial *T. canis* IgG/M ELISA kit (Novum Diagnostica, Germany) containing purified specific excretory *Toxocara canis* antigens from the larval stage. ELISA test was performed according to the manufacturer's instruction. Absorbance at 450 nm was measured using an ELISA microtiter plate reader. Sera were diluted as 5  $\mu\text{L}$  serum in 500  $\mu\text{L}$  of sample diluent. Cut-off value (CO) was calculated as the mean absorbance value of the two negative control determinations plus constant factor f (0.250), and more than 10% above CO was considered to be positive. If the patient absorbance value was found between 10% above to 10% below CO (in the grey zone), a new patient sample was investigated 2 - 4 weeks later. If the results after the second test also fell in the grey zone or below, they were considered to be negative.

**Table 2.** Comparison of Mean Age, Sex, Age Groups, Profession, Living Environment and Pet Ownership between Schizophrenic Patients and Control Group

	Schizophrenic patients	Control group	Statistics	
	n (%)	n (%)	$\chi^2$	p value
Mean age	18 - 67 ( $38 \pm 11$ yr)	18 - 60 ( $35 \pm 8$ yr)		
Sex				
Female	47 (48.0)	48 (48.0)	3.303	0.995
Male	51 (52.0)	52 (52.0)		
Age groups* (yrs)				
20 - 29	19 (19.4)	23 (23.0)	3.064	0.547
30 - 39	38 (38.8)	39 (39.0)		
40 - 49	21 (21.4)	22 (22.0)		
50 - 59	15 (15.3)	15 (15.0)		
$\geq 60$	5 (5.1)	1 (1.0)		
Profession				
None	81 (82.7)	70 (70.0)	5.588	0.061
Farmer	13 (13.3)	18 (18.0)		
Other <sup>†</sup>	4 (4.1)	12 (12.0)		
Living environment				
Rural	60 (61.2)	48 (48.0)	3.491	0.062
Urban	38 (38.8)	52 (52.0)		
Pet ownership				
No	89 (90.8)	82 (82.0)	3.267	0.071
Yes	9 (9.2)	18 (18.0)		

\*Three schizophrenic and control 18-19 years old persons were included in the 20-29 years age group.

<sup>†</sup>Include civil servant, worker (no soil-related), business man etc.

**Investigation of soil samples**

Thirty grams of soil or sand samples were taken from fifty different places in the hospital garden in order to determine the role of hospitalization in the *Toxocara* infection and the parasitic investigation of these samples was performed according to the ZnSO<sub>4</sub> flotation method described by Kazacos.<sup>13</sup>

**Statistical analysis**

Statistical analysis was performed with the statistical package for social sciences (SPSS/PC 9.05 version, 1998) using Chi square test and Fisher's Exact test if needed.  $p < 0.005$  was considered as statistically significant.

**RESULTS**

Seropositivity was detected in 45 of 98 schizophrenic patients (45.9%) and 2 out of 100 in the control subjects which showed statistically significant difference ( $p < 0.001$ ) (Table 3). However, there were no significant differences between the seropositive and seronegative schizophrenic patients in respect of professions, environment conditions, following up periods and number of hospitalizations (Table 1). Even when the schizophrenic patients were divided into 10-year age groups, there was no significant difference. The seroprevalence was 40.4% (19 cases) and 51.0% (26 cases) for female and male subjects, respectively ( $p = 0.295$ ) (Table 1). No significant difference was observed between the schizophrenic patients and control group in the analysis of population distri-

bution according to mean age, sex, age groups, profession, living environment and pet ownership (Table 2). No was any *Toxocara* or any other helminth egg or larva was not detected in the soil and sand samples obtained from the garden of the hospital.

**DISCUSSION**

Toxocariasis is an important health problem in developing countries and was classically described as a disease of children.<sup>5,6</sup> It has been reported that the seroprevalence of toxocariasis varies between 1.8 - 58.3% depending on country, study group, age and socio-cultural level.<sup>7,8,14-17</sup> There are only a few studies reporting toxocariasis prevalence in Turkey. Saglam has shown that the seroprevalence was 6% in students at veterinary college and 10% in people exposed to dogs.<sup>18</sup> He reported no toxocaral seropositivity in controls. We have previously shown that *T. canis* seroprevalence was 2.6% in healthy individuals in Elazig, an urban region in Turkey.<sup>19</sup> In the present study, we showed a *T. canis* seroprevalence of 45.9% in schizophrenic patients, which is much higher than in the control group.

The diagnosis of human toxocariasis currently depends on serological tests using excretory-secretory antigens from *T. canis* second-stage larvae (TES), because it is extremely difficult to detect an infective *Toxocara* larva(e) in biopsy samples. ELISA and western-blotting are the most commonly used methods to determine anti-*Toxocara* antibodies.<sup>15,20-24</sup> ELISA, which is practical and inexpensive, has been particularly recommended in seroepidemiological studies.<sup>15,25,26</sup> It has been

**Table 3.** Seropositive Subjects in Schizophrenic Patients and Control Group

<i>T. canis</i>	Schizophrenic patients		Control group	
	n	%	n	%
Seropositive	45	45.9*	2	2.00*
Seronegative	53	54.1	98	98.00
Total	98	100.00	100	100.00

\*Pearson Chi-Square;  $\chi^2 = 52.736$ .  
 $p < 0.001$ .

reported that use of TES antigens in ELISA is highly specific (86 - 100%) and sensitive (80 - 100%).<sup>15,17,25,26</sup> Cross reactions have been reported for serological tests in helminthic infections (such as brugianis, loiasis, trichinellosis, strongyloidiasis, gnathostomiasis, angiostrongylosis, anisakiasis, ascariasis, ancylostomiasis, schistosomiasis, paragonimiasis, fascioliasis, sparganosis and spiro-metriasias) when the TES are applied despite use of recombinant antigens.<sup>15,21-23,26</sup> In our region, these helminthic infections have not been reported except ascariasis (0.3 - 10.4%) and fascioliasis (2.8%).<sup>27-31</sup> Therefore, ELISA was utilized in the present study and it is believed that our results reflect the real prevalence of toxocariasis.

A comparatively high seroprevalence of *Toxocara* has been reported among persons living in rural communities, in keepers of dogs and/or cats, in those with the professions involving animal contact, in meat industry workers, in epileptics, in those with a history of pica and in those institutionalisation for mental retardation.<sup>9,11</sup>

Two reports have investigated the association between toxocariasis and institutionalization.<sup>10,11</sup> Institutes for mentally retarded children have been reported to be endemic foci of protozoan and helminth infections, including toxocariasis.<sup>11</sup> All of our patients were in-patients and were not institutionalised. They frequently had second, third or fourth admissions in this hospital but no patient had lifetime admission. There were unattended dogs and cats in the hospital's garden that the patients used. The presence of eggs and larvae of *T. canis* was investigated in soil samples taken from the garden in order to determine the role of hospitalization in the *Toxocara* infection. No *T. canis*, *T. cati* or any other helminth egg or larvae were detected in soil samples obtained from the garden of the hospital. This indicates that the area of the hospital where the patients were visiting was not contaminated at the time the study was performed. Additionally, there was no significant difference between *Toxocara* seropositive and seronegative patients in terms of follow up period and number of hospitalizations. Therefore, we suggest that *Toxocara* seropositivity may not be related to hospitalization.

The seroprevalence of *Toxocara* in childhood is higher than in adulthood.<sup>1,32</sup> All the schizophrenic

patients involved in this study were adults and no difference was found between the age groups with respect to *Toxocara* seropositivity, indicating a low correlation with age.

The high rate of *Toxocara* seroprevalence determined in schizophrenic patients could not be attributed to the factors including pet ownership, living environment and profession since the control group were selected with similar characteristics. Inadequate hygiene increases the risk of *Toxocara* infection.<sup>7,10-12</sup> Schizophrenic patients can be expected to behave in uncontrolled fashion with respect to hygiene. Furthermore, people exposed to more than one risk factor show higher prevalence rates. However, we did not observe any significant difference between either of the seropositive or seronegative schizophrenic patients and the control subjects in terms of the factors that increase *Toxocara* infection risk. Determination of high seroprevalence suggests that these subjects constitute a risk for *Toxocara* infection. The risk in mentally retarded cases could not be related with behavioural patterns on the basis of the present findings. Therefore, this issue awaits further investigations with a larger sample to evaluate the high seropositivity we have determined.

In conclusion, *Toxocara* seroprevalence (45.9%) was much higher in schizophrenic patients than in the general population. These results suggest that the schizophrenic state presents a high risk for *Toxocara* infection.

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