

The Frequency of *Toxocara* Infection in Mental Retarded Children

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Human toxocariasis is commonly seen in places where stray and Toxocara canis-infected dog population is high. There is a strong correlation between frequency of Toxocara infection, life style, and infection risk. Institutionalization of mental retarded patients increases to risk of toxocariasis. In this study, we aimed at investigating the frequency of Toxocara infection among children with mental retardation not requiring institutionalization. The study included 96 cases, who had educatable mental retardation and 85 healthy subjects who comprised the control group. Anti-Toxocara IgG or IgM antibodies were investigated in all serum samples, using ELISA method. The frequency of Toxocara infection was found significantly higher in mental retarded cases than in those in the control group (18.8% and 7.1% respectively) ($p < 0.05$). There was no significant difference between mental retarded children and the control group in terms of mean age, age groups, gender, owning dogs and cats and duration of their ownership, socio-economic level and behavioural factors, and personal hygiene ($p > 0.05$). We did not find any significant difference between Toxocara seropositive and seronegative mental retarded children in terms of demographic factors and epidemiological factors that could increase the risk of Toxocara infection ($p > 0.05$).

The present study is the first seroprevalence study carried out with a mental retarded group not requiring institutionalization. Determination of high frequency of Toxocara infection suggests that these subjects constitute a risk factor for Toxocara infection, which may be attributed to their behavioural patterns.

Key words: mental retarded children - *Toxocara canis* - toxocariasis

Toxocara canis, caused by zoonotic roundworms of dogs, is the cause of toxocariasis in man. Infectious *Toxocara* eggs are ingested and after that they hatch in the intestines. Larvae then migrate through the blood to the liver, lungs, and other organs. *T. canis* causes at least three syndromes in humans: toxocaral visceral larva migrans, ocular larva migrans, and covert toxocariasis (Garcia 2001).

Human toxocariasis is commonly seen in places where stray and *T. canis*-infected dog population is high. It is shown that there is a strong correlation between *Toxocara* seroprevalence, life style, and infestation risk (Di Fiore et al. 1989). Seroprevalence is high in developed countries, especially in rural areas among children who have dogs (Glickman et al. 1979, Genchi et al. 1990, Dubinsky et al. 1995, Holland et al. 1995). *Toxocara* seroprevalence is found high among various patient groups (Genchi et al. 1990, Buijs et al. 1994, Chan et al. 2001, Nicoletti et al. 2002). Institutionalized mental retarded are at particular risk; in one series, *Toxocara* infection was identified in 8.5% of institutionalized mental retarded adults in Israel (Huminer et al. 1992). In this study, we aimed at investigating the frequency of *Toxocara* infection among children with mental retardation not requiring institutionalization.

MATERIALS AND METHODS

The study was conducted between June 1 and October 10, 2002 in the cities Malatya, Elazığ, and Diyarbakir, which are located in the upper Euphrates, part of Eastern Anatolia, at an altitude of about 500-800 m. The cities are 101 and 151 km far from each other and have populations of 510.979, 376.915, and 581.208 respectively. The region is in the subtropical climatic zone, annual highest temperatures range between 2 and 38°C and lowest temperatures range between -5 and -20°C. Annual total number of rainy and snowy days range between 10 and 14.

Cases were mental retarded children attending public schools for special education in Malatya, Elazığ, and Diyarbakir. Ninety six students out of the total 112 (85.7%) participated in the study. These schools are educational institutions that offer 5 to 7 h of education and that accept students between 7 to 25 years of age, who are reported by a psychiatry clinic, paediatric psychiatry clinic or paediatrics clinic to have educatable (IQ > 25) mental retardation. Control subjects were children from the regular public school system in these cities, close to schools of mental retarded children, and chosen from among healthy and volunteering students who were from a similar age and gender group with mental retarded cases.

This study was carried out after being approved by the Ethics Committee of Firat University Medical School. After official permissions were taken from governor's office and school administrations, information and consent forms were prepared and given to parents of each subject in the both groups. Thus, parents were informed and their consent was taken. After that, a survey form was arranged and filled out by the help of subjects, their parents and

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school records. In order to find out the socio-economic level, educational level and jobs of the parents, total monthly income of the family, number of children, type of residence, and state social security were considered and socio-economic levels were classified as low, middle, and high.

Three ml of venous blood were taken under sterile conditions from each subject in the both group. Serum was separated and stored at -20°C until studied. Specific anti-*Toxocara* IgG or M antibodies were determined by ELISA (enzyme-linked immunosorbent assay; Novum Diagnostica, Germany) according to manufacturer's instructions.

The SPSS 10.0 for Windows package program was used to evaluate data. To compare mental retarded and control groups in terms of duration of keeping an animal and frequency of daily hand washes two independent samples was used; for other data chi-square was employed. $P < 0.05$ was accepted as statistically significant.

RESULTS

Of the 96 mental retarded cases who participated in the study, 70 (72.9%) were male and 26 (27.1%) were female. Their age range was between 7 and 24 (16 ± 4). Of the 85 subjects in the control group, 61 (71.8%) were male and 24 (28.2%) were female. They were between 6 and 25 years of age (15 ± 5). There was no significant difference between mental retarded cases and the control group in terms of mean age, age groups, gender, owning dogs and cats and duration of their ownership, socio-economic level, and behavioural factors and personal hygiene ($p > 0.05$) (Table I). The frequency of *Toxocara* infection in mental retarded cases was found to be significantly higher than that observed in the control group ($p < 0.05$) (Table II).

We did not find any significant difference between *Toxocara* seropositive and seronegative mental retarded cases in terms of demographical factors and epidemiological factors that increased the risk of *Toxocara* infection ($p > 0.05$) (Table III).

TABLE I
Demographical and epidemiological data for mental retarded cases and control group

	Mental retarded cases		Control group		Total	Statistics
	n	(%)	n	(%)		
Sex						
Male	70	(72.9)	61	(71.8)	131	NS
Female	26	(27.1)	24	(28.2)	50	
Age groups						
7-12	13	(13.5)	23	(27.1)	36	NS
13-18	67	(69.8)	45	(52.9)	112	
19-23	15	(15.6)	16	(18.8)	31	
≥ 24	1	(1)	1	(1.2)	2	
Owning dogs and cats						
No	93	(96.9)	82	(96.5)	175	NS
Yes	3	(3.1)	3	(3.5)	6	
Duration of ownership						
None	93	(96.9)	82	(96.5)	175	NS
In the past one year	1	(1)	-	-	1	
Longer than a year	2	(2.1)	3	(3.5)	5	
Living environment						
Urban	96	(100)	82	(96.5)	178	NS
Rural	-	-	3	(3.5)	3	
Socio-economic level						
Low	56	(58.3)	54	(63.5)	110	NS
Middle	40	(41.7)	31	(36.5)	71	
High	-	-	-	-	-	
Personal hygiene and behavioural patterns						
Frequency of daily hand washes						
1-2 times	11	(11.5)	23	(27.1)	34	NS
4-5 times	79	(82.3)	51	(60)	130	
≥ 6 times	6	(6.3)	11	(12.9)	17	
Geophagia						
No	95	(99)	81	(95.3)	176	NS
Yes	1	(1)	4	(4.7)	5	
Nail-biting						
No	90	(93.8)	81	(95.3)	171	NS
Yes	6	(6.3)	4	(4.7)	10	
Sucking fingers						
No	88	(91.7)	82	(96.5)	170	NS
Yes	8	(8.3)	3	(3.5)	11	

NS: not significant

TABLE II
Toxocara seroprevalence in the mental retarded cases and control group

	Mental retarded cases		Control group		Total	Statistics
	n	(%)	n	(%)		
<i>T. canis</i> seronegative	78	(81.3)	79	(92.9)	157	Pearson Chi-Square 5.358 0.021
<i>T. canis</i> seropositive	18	(18.8)	6	(7.1)	24	
Total	96	(100)	85	(100)	181	

TABLE III
Comparison of *Toxocara* seropositive and seronegative mental retarded cases

	<i>Toxocara</i>				Total	Statistics
	Seronegative		Seropositive			
	n	(%)	n	(%)		
Sex						
Male	57	(73.1)	13	(72.2)	70	NS
Female	21	(26.9)	5	(27.8)	26	
Age groups						
7-12	11	(14.1)	2	(11.1)	13	NS
13-18	53	(67.9)	14	(77.8)	67	
9-23	14	(17.9)	1	(5.6)	15	
≥ 24	-	-	1	(5.6)	1	
Owning dogs and cats						
No	75	(96.2)	18	(100)	93	NS
Yes	3	(3.8)			3	
Duration of ownership						
None	75	(96.2)	18	(100)	93	NS
In the past one year	1	(1.3)	-	-	1	
Longer than a year	2	(2.6)	-	-	2	
Living environment						
Urban	78	(100)	18	(100)	96	
Rural	-	-	-	-	-	
Socio-economic level						
Low	46	(59)	10	(55.6)	56	NS
Middle	32	(41)	8	(44.4)	40	
High	-	-	-	-	-	
Personal hygiene and behavioural patterns						
Frequency of daily hand washes						
1-2 times	7	(9)	4	(22.2)	11	NS
4-5 times	65	(83.3)	14	(77.8)	79	
≥ 6 times	6	(7.7)	-	-	6	
Geophagia						
No	77	(98.7)	18	(100)	95	NS
Yes	1	(1.3)	-	-	1	
Nail-biting						
No	74	(94.9)	16	(88.9)	90	NS
Yes	4	(5.1)	2	(11.1)	6	
Sucking fingers						
No	72	(92.3)	16	(88.9)	88	NS
Yes	6	(7.7)	2	(11.1)	8	

NS: not significant

DISCUSSION

Toxocara seroprevalence is found high among various patient groups like asthmatic and epileptic patients (Glickman et al. 1979, Genchi et al. 1990, Buijs et al. 1994, Chan et al. 2001, Nicoletti et al. 2002). Various studies state that *Toxocara* seroprevalence in institutionalized mental retarded cases is between 10.6 and 20% (Brook et

al. 1981, Genchi et al. 1990, Huminer et al. 1992). Huminier et al. (1992) report that having mental retardation requiring institutionalization is a risk factor increasing *Toxocara* seroprevalence. We found no study reporting the frequency of *Toxocara* infection in mental retarded cases who were not institutionalized or whose mental retardation did not require institutionalization in the literature.

In this study, the frequency of *Toxocara* infection in educatable mental retarded cases who had not required institutionalization and having special education was found to be 18.8%. This rate is statistically higher than the rate identified in the control group. *Toxocara* seroprevalence may vary according to geographical region where the study is made and even to different populations inhabiting the same region (Buijs et al. 1994, Moreira-Silva et al. 1998, Alonso et al. 2000, Baboolal & Rawlins 2002). When compared with seroprevalence rates ranging between 2.7 and 73%, reported by different studies (Buijs et al. 1994, Moreira-Silva et al. 1998, Kaplan et al. 1999, Alonso et al. 2000, Baboolal & Rawlins 2002) the rate of 18.8%, which we found for the educatable mental retarded group, may not be considered very high. The observation of a high frequency of *Toxocara* infection in mental retarded cases compared to the control group suggests that these cases in our region may be considered under risk for *Toxocara* infection.

It is reported that *Toxocara* seroprevalence is high in those owning dogs and cats (Arpino et al. 1990, Holland et al. 1995, Garcia 2001, Chan et al. 2001, Baboolal & Rawlins 2002). It is seen that in our mental retarded cases, the rate of owning cats-dogs at home was low and did not influence seroprevalence. However, the contact with the soil contaminated by cats and dogs faeces could be the main cause for observed high seropositivity. It is reported that the risk factor for toxocariasis is contact with soil contaminated with cat-dog faeces, rather than owning a cat or dog at home (Overgaauw 1997, Ajayi et al. 2000, Garcia 2001). Climatic conditions of our region are conducive to keeping *T. canis* eggs alive for a long time. It can be said that the places where mental retarded and control group subjects lived had similar conditions in terms of contamination with cat-dog faeces. However, the duration of being in these places and the manner of using the places may be factors that increase contamination of mental retarded and that make seroprevalence higher.

Personal hygiene and behavioural factors e.g. geophagia, nail-biting, sucking fingers, and frequency of daily hand washes could also lead to increase *Toxocara* seroprevalence (Arpino et al. 1990, Huminer et al. 1992, Ajayi et al. 2000, Sadjjadi et al. 2000, Garcia 2001, Baboolal & Rawlins 2002). It is seen that these factors did not affect the frequency of *Toxocara* infection in our mental retarded cases. According to our result, there was no difference between the educatable mental retarded group and the control group in terms of these factors. Similarly, when the mental retarded group was divided within itself as seropositive and seronegative, there were no significant differences between them with respect to these factors. Therefore, we think that the frequency of *Toxocara* infection we found for the educatable mental retarded group was not affected by these factors.

Toxocariasis is seen more frequently among children than among adults due to such reasons as frequent contact with contaminated soil, poor hygiene, and consuming contaminated food (Holland et al. 1995, Overgaauw 1997, Radman et al. 2000, Garcia 2001). The mental retarded group in the present study consisted of children and young adults whose ages ranged between 7 and 24 (16 ±

4), and seropositivity was not affected by age groups.

Socio-economic level is a factor that influences *Toxocara* seroprevalence (Herrmann et al. 1985, Matos et al. 1997). While some studies report that *Toxocara* seroprevalence increases with low socio-economic status (Magnaval et al. 1994, Matos et al. 1997, Alonso et al. 2000), there are others which claim that it does not change (Buijs et al. 1994, Sadjjadi et al. 2000). In the current study, mental retarded and control groups included students from homogenous, low, and middle socio-economic status. On the other hand, it is seen that there was no difference between *Toxocara* seropositive and seronegative mental retarded cases in terms of socio-economic level. Therefore, we think that the frequency of *Toxocara* infection difference between mental retarded cases and control group does not stem from socio-economic status.

In conclusion, to date, our study is the first report of the frequency of *Toxocara* infection in educatable mental retarded cases. Mental retarded subjects not-requiring institutionalization are under risk of infection with *Toxocara*. The present findings showed that *Toxocara* seroprevalence was not affected by demographic and epidemiological factors that increase the risk of *Toxocara* infection. It is suggested that this risk in mental retarded cases may result from behavioural patterns.

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