

# Seroprevalence of toxocariasis in children aged 1–9 years in western Islamic Republic of Iran, 2003

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معدل الانتشار المصلي لداء السهميات بين الأطفال من عمر 1 إلى 9 سنوات في غرب جمهورية إيران الإسلامية سنة 2003

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**الخلاصة:** درسي الباحثون معدل الانتشار المصلي للعدوى بالسهميات الكلبيية لدى 544 طفلاً دون سن العاشرة، اختبروا عشوائياً من المناطق الريفية والحضرية في همدان. واستخدموا مقياساً المناعي المرتبط بالإنزيم لكشف أعداد السهميات الكلبيية ومستضدات مفرغاتها ومفرزاتها؛ ودرسوا، باستخدام استبيان خاص، العوامل الإبيديميولوجية المرافقة للعدوى، وتشمل العمر، والجنس، ومحل الإقامة. واكتشف الباحثون أعداداً السهميات الكلبيية لدى 29 طفلاً (5.3%)، في حين كانت لدى 19 طفلاً (3.5%) إيجابية حدية، مما يجعل معدل انتشار داء السهميات يصل إلى 8.8%، ولم يجد الباحثون فروقاً يُعتدُّ بها إحصائياً من حيث توزع الجنس والعمر ومحل الإقامة.

**ABSTRACT** We determined the seroprevalence of *Toxocara canis* infection in 544 children under 10 years randomly selected from urban and rural areas of Hamadan. An enzyme-linked immunosorbent assay was used for detection of antibodies to *T. canis* excretion–secretion antigens. Using a questionnaire, epidemiological factors associated with infection were examined, including age, sex, residence. Antibodies to *T. canis* were detected in 29 children (5.3%) and 19 children (3.5%) were categorized as borderline positive; thus together this gave a prevalence of toxocariasis of 8.8%. No significant differences were found in terms of sex, age and residence.

## Séroprévalence de la toxocarose chez l'enfant de 1 à 9 ans dans la région occidentale de la République islamique d'Iran en 2003

**RÉSUMÉ** Nous avons déterminé la séroprévalence de l'infection à *Toxocara canis* chez 544 enfants de moins de 10 ans résidant dans les zones rurales et urbaines d'Hamadan et sélectionnés au hasard. La détection des anticorps contre les antigènes excrétoires-sécrétoires de *T. canis* a été effectuée à l'aide d'un test immunoenzymatique (ELISA, pour *enzyme-linked immunosorbent assay*). Un questionnaire a permis l'évaluation des facteurs épidémiologiques associés à l'infection, notamment l'âge, le sexe et le lieu de résidence. Des anticorps anti-*T. canis* ont été détectés chez 29 enfants (5,3 %), tandis qu'une positivité limite a été enregistrée chez 19 autres (3,5 %), établissant ainsi une prévalence de la toxocarose à 8,8 %. Aucune différence significative n'est apparue liée à l'âge, au sexe ou au lieu de résidence.

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## Introduction

*Toxocara canis* is one of the commonest nematodes of the dog and most often this nematode is the cause of toxocariasis (visceral larva migrans) [1]. People become infected by ingestion of eggs from soil, dirty hands (thumb-sucking) and raw vegetables. Pica has an important role in the acquisition of this infection. Once embryonated eggs are ingested, the larvae hatch and migrate through the somatic organs [2].

In humans, migration of *T. canis* larvae to viscera and other organs produces visceral larva migrans syndrome, and sometimes ocular larva migrans and neurotoxocariasis [3].

Toxocariasis is considered to be a disease mainly of children, although adults can also be affected. Children are more at risk of acquiring this infection because of their attraction to pets (dogs and cats) and their play habits, which may expose them to accidental ingestion of *Toxocara* eggs from the animal hosts.

Direct confirmation of larva in internal organs is extremely difficult. Emphasis is placed on diagnosing visceral larva migrans and ocular larva migrans by indirect serological methods [4]. Diagnosis of human toxocariasis through most immunological tests is done using *T. canis* excretion-secretion antigens, most often by enzyme-linked immunosorbent assay (ELISA) [5,6].

There have been few epidemiological studies on the prevalence of toxocariasis in the Islamic Republic of Iran, especially in western parts such as Hamadan, except some sporadic reports of disease in children [7]. In this province human ascariasis is endemic and canine ascarids are common as well [8]. In central Hamadan, *Ascaris lumbricoides* prevalence is reported to be 20%, and the prevalence of canine ascarids

is reported to be about 51% in stray dogs [9] and there are thousands of stray dogs in and around the city without any control measures. Soil-contamination by *Toxocara* eggs in public parks has been reported previously [10,11] and clinical evidence suggests the presence of human toxocariasis in this region. Environmental and sociocultural conditions facilitate infection with *Toxocara* eggs in humans, especially children. As there is a lack of documented reports on the seroepidemiology of toxocariasis in our area, we aimed to assess the prevalence of the infection in children under 10 years of age and its association with certain factors.

## Methods

The study was carried out from July to September 2003 in Hamadan. The total population of Hamadan is about 600 000, and the target population (under 10 years old) was about 101 000 [12]. A total of 544 children aged 1–9 years (278 girls and 276 boys) were randomly selected from urban (408, 75%) and rural (136, 25%) areas of Hamadan. The children were selected from areas covered by 10 health centres in the city and 9 health centres in the rural areas. All members of households in the catchment areas of the health centres have a health file and code and this was the sampling frame from which the children were selected. Sample size was calculated proportionally according to residence with a probable prevalence of 15% in urban areas and 3% in rural areas with 95% confidence interval.

Data were collected using a questionnaire which included epidemiological factors such as age, sex, residence, parents' educational status, a history of close contact with dogs and/or cats, keeping pets in the home, exposure to soil, pica, eating raw

vegetables, mode of vegetable washing, thumb-sucking and frequency of visits to outdoor parks. The questionnaires were completed by the parents and health staff.

Venous blood samples (3 mL) were collected from each child for detection and titration of antibodies to *T. canis*. Serum was separated on the same day as collection at the centre and then frozen at  $-20^{\circ}\text{C}$  until analysis. Informed consent was obtained from the parents for their child to participate.

The ELISA/IgG diagnostic kit was supplied by Test-Line Ltd Clinical Diagnostics, Czech Republic. The manufacturer claims a high specificity of 99.2% and sensitivity of 100%. The ELISA procedure was carried out according to the manufacturer's instructions. An automated washer (Asys Sera Washer, Austria) and automated reader (Rosys Authos, Spain) were also used. The base serum dilution in this method was 1/200. The intensity of colour of each well was read at 450 nm against the blank. Results were considered valid if the absorbance of the blank was less than 0.150, of the positive control was  $\geq 0.900$  and of the negative control was  $\leq 0.200$ , and the mean absorbance of cut-off was between 0.250 and 0.600. For evaluation of the results, index positivity was used (absorbance of each tested sample divided by the mean absorbance of the cut-off that was obtained in the same test); the cut-off was calculated and appointed to 0.3. According to the manufacturer recommendations, an index positivity  $> 1.1$  was considered positive, 0.9 to 1.1 as borderline and  $< 0.8$  as negative for *T. canis* infection.

### Statistical analysis

Data were analysed by SPSS, version 10 and the chi-squared test was used to assess statistical differences.  $P < 0.05$  was considered significant.

## Results

Of the 544 samples analysed, 29 were positive for *Toxocara* antibodies giving an overall prevalence of 5.3%, obtained at a cut-off titre of 1/200. In addition, 19 (3.5%) of the samples had a borderline titre. Thus including the borderline cases as positive, we have a prevalence of toxocariasis of 8.8%. Of the 29 children positive for toxocariasis, 24 had a low titre, 4 a medium titre and only 1 had a high titre (Table 1). Table 1 also shows the prevalence of antibodies to *Toxocara* according to age, sex and residence; other variables examined were either not significant or incomplete and were excluded and are not shown. There was no significant difference in the seropositivity according to sex (5.3% males, 5.63% females,  $P = 0.54$ ) or age group (1–3 years 5.66%, 4–6 years 5.3% and 7–9 years 5.28%,  $P = 0.97$ ). Although a lower prevalence was found in the urban areas (5.63%) compared with the rural areas (4.41%), this was not statistically significant ( $P = 0.69$ ).

## Discussion

We found the prevalence of confirmed toxocariasis to be 5.3%; with the borderline cases included, this rose to 8.8%. We expected a higher prevalence rate in this region because of the environmental and cultural conditions. Because the prevalence of infection varies in different geographical regions, it may be that the positivity index recommended by the manufacturers is not appropriate for developing countries such as ours and the assessment of antibodies should, as much as is practical, take account of special regional conditions.

Seropositive rates for *T. canis* have been reported to be 2.8% in the general population and 4.6%–7.3% in children 1–11 years old in the United States [11], 10.9% in Jor-

Table 1 Epidemiologic features for *Toxocara* infection in children aged 1–9 years, Hamadan, western Islamic Republic of Iran

Variable	No. of samples analysed	Samples positive No. (%)	Samples negative No. (%)	Samples borderline No. (%)	Odds ratio	95% confidence interval	P-value
<i>Age (years)</i>					0.87	0.62–1.38	0.97
1–3	53	3 (5.7)	49 (92.5)	1 (1.9)			
4–6	264	14 (5.3)	240 (90.9)	10 (3.8)			
7–9	227	12 (5.3)	207 (91.2)	8 (3.5)			
<i>Sex</i>					0.92	0.64–1.2	0.54
Male	278	14 (5.0)	252 (90.6)	12 (4.3)			
Female	266	15 (5.6)	244 (91.7)	7 (2.6)			
<i>Residence</i>					0.84	0.58–1.34	0.69
Rural	136	6 (4.4)	124 (91.2)	6 (4.4)			
Urban	408	23 (5.6)	372 (91.2)	13 (3.2)			

dan [13], 25.6% (132/519) in Shiraz, eastern Islamic Republic of Iran [8] and 3.1% (70/2129) in Ireland [14]. Other studies report seropositivity rates of 3.1% (16/314) in Korea [15], 17.7% and 2.1% in rural and urban children respectively in China [16], 62.3% in schoolchildren in Trinidad [17], and 3.6% and 17.2% in 2 different areas of Spain (Madrid and Tenerife) [18].

While we expected a higher seropositivity rate among this group of children, nonetheless the rate of 8.8% was considerably higher than that expected for the general population (2.0% to 2.5%). The absence of a significant difference in the rate of positivity between families who owned a dog and those that did not suggests that infection was being acquired from communal sources such as parks and playgrounds. Soil contamination of public parks and playgrounds in Hamadan has been reported previously [10]. Furthermore, keeping dogs is not popular in either urban or rural areas because of Islamic beliefs about dogs. Therefore, the contamination of the environment with *T. canis* eggs from stray dogs is probably the common source of infestation of children. The potential transmission of infection in

children is undoubtedly greater than adults because children often play in the contaminated environments. The considerable proportion of children who had been infected indicates the need for control of the canine pollution in the area.

In conclusion, the prevalence of toxocariasis among children in western parts of the Islamic Republic of Iran is the same as some other developing countries but lower than southern parts of the country. Nevertheless, it is relatively high, as is the prevalence of canine ascarids in this area and soil contamination of public parks with eggs. Therefore, toxocariasis does constitute a health problem in this area that needs to be addressed.

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