Latent and Asymptomatic *Toxocara* Infection among Young Population in Northwest Iran: The Necessity of Informing People as a Potential Health Risk

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**Objectives.** This study was designed to determine the frequency of anti-*Toxocara* antibodies in youngsters aging from 2 to 20 years in northwest Iran. **Materials and Methods.** 397 samples were taken randomly almost equally from four locations in Urmia, west Azerbaijan, during August 2014 to September 2015. Anti-*Toxocara* IgG antibody assays were done on sera by using ELISA kit (IBL, Germany). In order to prevent cross-reaction, the samples of the patients who are infected with other parasites in stool exam, especially Ascarididae family, were also excluded. SPSS 16.0 software was used for statistical analysis. **Results.** 12 (3%) of the serum samples were positive for anti-*Toxocara* IgG. According to the Chi-square analysis, risk factors such as mother’s educational level, keeping dogs or cats as pets, and history of coughing were related to *Toxocara* infection \((P < 0.05)\). There was no relationship between toxocariasis and gender, history of onychophagy, pica, fever, abdominal pain, and anorexia; however, we found a significant relationship between *Toxocara* infection and chronic coughing \((P = 0.045)\). **Conclusion.** Toxocariasis in northwest Iran can be considered as a public health problem. This study may also help to increase the awareness about this infection.

**1. Introduction**

Human toxocariasis is one of the canine parasitic infections caused by the larva stage of the genus *Toxocara*. This disease was first described in the 1950s and was long considered an abnormal illness among children. This parasite, which has global distribution, may be found in both mankind and animals. The prevalence rate varies from one location to another. Newfound information, concerning this parasite, led to knowledge of the various syndromes caused by this infection \([1, 2]\). Clinical signs and complications which result from infection with this parasite are mostly dependent on the number and migration locations of *Toxocara* larvae, mainly categorized to three groups: migrating visceral larvae, ocular larvae, and covert form. In human, asthma, loss of vision, hypereosinophilia, encephalitis, and problems involving the liver, lungs, and the CNS are the most important complications caused by this parasite \([3]\). Previous investigation indicated a relationship between epileptic seizures and infection with various types of *Toxocara* parasite \([4]\). In addition, a study performed about ocular toxocariasis in order to introduce better diagnosis and treatment showed that this parasite is still affecting many children and causing many complications, such as permanent blindness in the patients \([5]\). Numerous factors such as life style, environmental contamination, keeping pets, and economic and social parameters are also important in the prevalence of *Toxocara* infection in human \([6, 7]\). A study performed in Tabriz, Iran, showed that most of pet owners had a high contact risk with this parasite \([8]\). Different studies have been conducted to determine the relevance between the serum prevalence of toxocariasis and hypereosinophilia; according to the results,
such a relation does indeed exist [9–11]. For example, anti-
Toxocara antibodies and their relation with the age, sex, and
peripheral eosinophils in lymphatic filariasis patients have
been studied in northeastern Brazil [12]. Many investigations
have been performed in various regions for the detection of
Toxocara eggs from soil sources and also the determining of
the presence of anti-Toxocara antibodies in their residents.
Recently, similar studies have also been performed in Iran
to determine the infection rate of Toxocara in canine [13–
15]. Seroepidemiological analysis of toxocariasis infection
among children was done in Zanjan; the results indicate that
the infection rates were lower in comparison to other cities.
Increasing the hygiene levels is considered to be a paramount
factor in the controlling of this infection [16]. Based on the
only study conducted in Urmia, west Azerbaijan that solely
aimed to determine the levels of Toxocara egg in the soil
of parks, a contamination rate of 7.8% was reported [17]. In spite
of the fact that some seroepidemiological studies have been
performed in different regions of Iran and also considering
the high contamination rate of the soil of the Urmia parks
[17], the serum prevalence of toxocariasis remains as an
unresolved problem in this region. Accordingly, the present
study has been approved by the ethics committee of Urmia, west Azerbaijan that solely
as an unresolved problem in this region. Accordingly, the present
study was designed for the first time to determine the
frequency of anti-Toxocara antibodies in youngsters aging
from 2 to 20 years in Urmia, northwest Iran. The results and
findings of this study will be made available for other
researchers, as well as health officials in the hope of helping
them to better evaluate the prevalence and distribution of this
parasite in the northernwestern regions of the country, especially
west Azerbaijan.

2. Materials and Methods

In this cross-sectional study, 397 samples were taken ran-
domly from 2 to 20 years almost equally from four locations
in Urmia during August 2014 to September 2015. To increase
the reliability of the tests, hyperlipidaemic and haemolysed
samples were removed from the study. In order to prevent
cross-reactions between Toxocara larvae and other organ-
isms’ antigens, stool exam by using wet mount and formalin-
ethyl acetate technique was also performed and patients who
are infected with the other parasites in stool exam, especially
Ascarididae family, were excluded. Age and gender ratios
were kept constant between the regions. This study has been
approved by the ethics committee of Tabriz University of
Medical Sciences, Iran. After receiving a written informed
consent, a questionnaire including age, sex, education level,
keeping dogs and/or cats, geophagy, onchocerciasis, fever,
chronic coughing, abdominal pain, and anorexia was filled
for each person along with sampling. In the present inves-
tigation, we also measured some hematological parameters
such as HCT, Hb, and ESR values and PLT, RBC, and WBC
count. After collecting about 2–2.5 mL of the whole blood
samples in tubes and preparing blood smears in order to
confirm eosinophilia, sera were separated and stored at
−20°C. Anti-Toxocara IgG antibody assays were done on sera
by T. canis excretory-secretory (TES) antigens using ELISA
kit (IBL, manufactured in Hamburg, Germany) according to
the manufacturer’s instructions. SPSS 16.0 software was used
for statistical analysis. Quantitative and qualitative parame-
ters were evaluated by independent sample t-test and Chi-
square, respectively. Finally P value < 0.05 was considered as
significant level.

3. Results

From a total of 397 serum samples, 12 (3%) were positive
for anti-Toxocara IgG by using ELISA technique. The other
385 (97%) samples were negative. The infection rate in
female and male was 1.4% and 4.8%, respectively. There
was no significant relationship between gender and Toxocara
infection rates (P = 0.054). 10.3% of seropositive individuals
had a history of keeping pets especially cat or dog. Hence, in
this study, a significant relationship was observed between pet
held and infection with the parasite (P = 0.003). In terms of
clinical signs, 5.7%, 5.9%, 4.8%, 6.1%, 4.7%, and 3.5% of
the patients had onychophagy history, pica, fever, chronic
coughing, abdominal pain, and anorexia, respectively. There
was no statistical significant relationship between toxocaria-
sis history of onychophagy, pica, fever, abdominal pain,
and anorexia; however we found a significant relationship
between Toxocara infection and chronic coughing (P =
0.045). Although, education level of seropositive cases and
father of the patients had no impact on the disease in
this investigation, but the patient’s mother’s education level
has been effective to the rate of infection (P = 0.042).
Hematologic parameters in Toxocara positive and negative
cases are described and compared (Table 1). Quantitative
analysis showed that an increase in the numbers of peripheral
eosinophils, which were counted using the prepared blood
smears, was seen in the sample of the patients whose serum
was positive for anti-Toxocara antibodies. In addition, the
ES rate of positive samples was about 2.3 times of IgG
negative samples. This increase is indicative of inflamma-
tion in patients with Toxocara. In this study, stool exam
was also performed along with serological evaluation. After
sedimentation by using formalin-ethyl acetate technique, all
samples were examined microscopically. The results showed
that overlay 26 (6.55%) of samples were infected with different
parasites that among them three seropositive samples were
also infected with the other parasites (Table 2). In the present
study, we did not see any egg of Ascarididae family parasites.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Seronegative (M ± SE)</th>
<th>Seropositive (M ± SE)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td>WBC</td>
<td>8.3 ± 0.19</td>
<td>8.44 ± 1.26</td>
<td>0.904</td>
</tr>
<tr>
<td>RBC</td>
<td>4.68 ± 0.03</td>
<td>4.63 ± 0.17</td>
<td>0.826</td>
</tr>
<tr>
<td>ESR</td>
<td>18.7 ± 0.88</td>
<td>42.0 ± 9.85</td>
<td>0.000</td>
</tr>
<tr>
<td>Hemoglobin</td>
<td>12.49 ± 0.07</td>
<td>12.54 ± 0.44</td>
<td>0.914</td>
</tr>
<tr>
<td>Hematocrit</td>
<td>37.95 ± 0.19</td>
<td>38.05 ± 1.17</td>
<td>0.926</td>
</tr>
<tr>
<td>Platelets</td>
<td>282.18 ± 5.17</td>
<td>287.83 ± 31.02</td>
<td>0.850</td>
</tr>
<tr>
<td>Neutrophils</td>
<td>54.34 ± 0.87</td>
<td>59.83 ± 5.16</td>
<td>0.275</td>
</tr>
<tr>
<td>Lymphocytes</td>
<td>37.05 ± 0.81</td>
<td>29.42 ± 5.64</td>
<td>0.106</td>
</tr>
<tr>
<td>Monocytes</td>
<td>4.95 ± 0.19</td>
<td>6.25 ± 1.44</td>
<td>0.795</td>
</tr>
<tr>
<td>Eosinophils</td>
<td>2.50 ± 0.11</td>
<td>4.50 ± 1.07</td>
<td>0.002</td>
</tr>
<tr>
<td>Basophiles</td>
<td>0.09 ± 0.02</td>
<td>0.0 ± 0.0</td>
<td>0.086</td>
</tr>
</tbody>
</table>
Table 2: Parasites found in samples after stool examination by using wet mount and formalin-ethyl acetate technique.

<table>
<thead>
<tr>
<th>Parasite</th>
<th>Seronegative</th>
<th>Seropositive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Giardia lamblia</td>
<td>11</td>
<td>2</td>
</tr>
<tr>
<td>Blastocystis hominis</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>Entamoeba histolytica</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Oxyur eggs</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Dicrocoelium eggs</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>23</td>
<td>3</td>
</tr>
</tbody>
</table>

4. Discussion

Seroepidemiological studies in different countries have shown the global distribution of toxocariasis. In developed countries, visceral larvae migrans is considered to be the second most common worm infection in human. Although in developing countries other worm infections are more common, but reports indicate high infection rates by *Toxocara* larvae [14, 15]. In the present study, we detected anti-*Toxocara* antibody in 3% of samples. According to the results, seropositive patients had significantly higher eosinophilia in comparison with seronegative cases, indicating a relationship between toxocariasis and hypereosinophilia. In the previous studies, hypereosinophilia was also reported to relate to *Toxocara* infection [18]. For example, in a study performed in Chungcheongnam, South Korea, on hypereosinophil patients, it was observed that toxocariasis is related to the condition, which may have been the result of consuming raw cow liver and play a significant role in the transmission of the parasite [10]. Another study was performed with the aim of determining the serum prevalence of anti-*Toxocara* antibodies in children with chest wheezes in Tehran. The results indicate that children who were attending school had the highest prevalence of infection in comparison with the other groups who have had hypereosinophilia and allergic reactions [11]. In a study conducted by Kim et al. on the adult population of Seoul, amongst the 97 patients who were studied, 63 (65%) had anti-*Toxocara* antibody [19]. Also, in a study performed in Shiraz, southern Iran, on children aged 6 to 13 years, prevalence rate was reported to be about 25.6%. Amongst those infected, 20.2% resided in rural areas, while 30.1% were city residents. The results of this study vary from that of those conducted in other regions which is said to be related to the high infection prevalence of the cats and dogs with parasites such as *T. cati* and *T. canis* [20]. In other previous studies that were performed in Iran and Turkey, no relationship was observed between the infection rate and children residency [21, 22].

Different prevalence in the studies may be the result of many factors such as more contact with infected cats and dogs in rural regions. In addition, the contact prohibition with canines and felines varies in different religions. For example, in Islam, it is strictly forbidden to come in contact with dogs, or any other material for that matter, which has been in any way exposed to the animal itself, or its urine and faeces. On the other hand, kits and the cut-off used in data analysis may also be different from one study to another. In the present study, according to the Chi-square analysis, no significant relationship was observed between toxocariasis and onychophagy, education level, gender, abdominal pain, fever, and anorexia (P < 0.05). Fallah et al. also conducted a study in western Iran, on children aging from 1 to 9 years; no relevance was seen between age, sex, and area of residency. According to the study carried out in Sparta, southwestern Turkey, environmental pollution and life style strongly affect the epidemiology of toxocariasis [7]. The prevalence of toxocariasis was studied in three of the city outskirts in Campinas, Brazil; the results showed the significant effect of socioeconomic parameters on human infection rates [6]. These researches and their findings are consistent with the results of the present study. In a seroepidemiological study which was conducted in Iran, no significant relationship was observed between infection rate and age/gender [23, 24]. In addition, the study performed in Tabriz determined that the gender is irrelevant to the presence of anti-*Toxocara* antibodies (P = 0.275) [8]. The results of both studies are consistent with that of ours. Contrary to our findings, in some studies, the relevance between gender and infection rate was reported to be significant and meaningful. For example, in a study performed in Trinidad, infection rates were considerably higher in boys when compared to girls [13]. In northern Jordan, significant differences were seen in infection rates between girls and boys; this difference is mostly related to the games and habits of young boys [25]. Although the infection rate in this study is higher in boys than girls, this difference is of no analytical value and significance. According to the Chi-square analysis, the frequency of infection was related to mother's education level and area of residence. This may be due to culture and behavioural attributes concerning the contact between their child and infected soils. Based on the findings of this study, chronic coughs are also related to the infection rate.

Although in some studies the relationship between contact with dogs or cats and larva migrans syndrome has been reported, other researchers have not observed such relevancy. In a study that was performed in Tabriz, a significant relationship was reported between contact with cats or dogs and *Toxocara* infection rate [8]. But, in contrast, in a study performed by Alavi et al., significant relation was not seen between the prevalence of toxocariasis and contact with dogs which may be due to religious and cultural beliefs [9, 23]. According to a study that is aiming to determine the relevance between *Toxocara canis* infection and raw cow liver consumption, keeping dogs and consuming raw cow liver significantly increase infection rate [26]. According to some investigations, although the natural host of *Toxocara* parasites is mainly canines and felines, the risk of coming in direct contact with these animals is not exponentially high. This is because the eggs are usually discharged through faeces and require at least two week to reach noticeable infectivity. However, dogs that are kept in the same environmental conditions are considered a constant risk for migrating larvae [27].

Different serological methods are available for detecting anti-*Toxocara* antibody in human serum. Among these methods, IFA test is capable, useful and sensitive but this method...
requires a highly laboratory equipment and trained personnel and also there is no commercially standardization for this purpose. In comparison, ELISA method is much simple, with easier performance and does not require any complicated equipment. It has commercially available kit with appropriate sensitivity and specificity and it is recommended as effective and useful method in seroepidemiological studies of human toxocariasis [28, 29]. In the present study, we used ELISA kit to recognize anti-Toxocara IgG antibody in serum samples and also stool exam was performed to prevent cross-reactions.

5. Conclusion

Toxocariasis in northwest Iran can be considered as a public health problem. The clinical signs especially chronic coughs, hypereosinophilia, hepatomegaly, or nonspecific pulmonary diseases may be confused with toxocariasis diagnosis. It is necessary for physicians to consider the clinical symptoms of this infection and its similarity with other diseases. This study may also help us to increase the awareness about this infection, as well as having an impact on the care which veterinarians should take in treating intestinal worms. Most of all, this study emphasizes the need of controlling stray dogs in the environment.

Disclosure

This paper is derived from the master’s thesis of the Tina Momeni.

Conflict of Interests

The authors declare that there is no conflict of interests.

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