Original Article

Intestinal Helminths in Different Species of Rodents in North Khorasan Province, Northeast of Iran

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Abstract

Background: Rodents are an important source of zoonotic diseases for human. The aim of this study was to determine the infectivity of rodents with intestinal helminths in North Khorasan Province, Iran.

Methods: One hundred and thirteen rodents were collected using different collection methods such as kill and live traps, digging of their burrow, filling of their hiding places with water and hand net during 2011-2013. Their alimentary canals were removed in the laboratory and helminths were determined in the department of parasitology, Tehran University of Medical Sciences.

Results: Thirteen species of helminths parasites were found in 13 species of rodents, including Aspiculuris tetraptera, Hymenolepis diminuta, Nippostrongylus brasiliensis, Protospirura Sourat, Rictolaria ratti, Skrjabinitaenia lobata, Streptopharynx kuntzi, Syphacia obvelata, Taenia taeniaeformis, Trichuris muris, Cysticercus fasciolaris, Acanthocephal. spp and Trichuris spp. Some of them were reported for the first time in new host in Iran. S. obvelata and A. tetraptera were the most frequent parasites and P. Sourat, R. ratti and C. fasciolaris were found only in one rodent.

Conclusion: This is the first study to investigate the intestinal parasites in rodents in this area. Among different species identified, some of helminths were reported in new host.
Introduction

Rodents are the most widely distributed and largest group of small mammals in the worldwide (1) and have been reported as one of the most important groups of parasite and infection reservoirs.

The helminth faunas of small mammals have been studied and documented in many countries (2-6) and the occurrence of zoonotic parasites of rodents has been studied extensively.

There are some reports on the infectivity of rodents with parasites in some areas of Iran. Three species of rodents were trapped from different localities of Khuzestan Province, southwest of Iran and Tribozooides crassicauda were the most prevalent species of helminth parasites (7). Endoparasites were detected in Meriones persicus and Microtus socialis in Ardabil Province, North West of Iran (8). Endoparasites have also been isolated from Mus musculus, Rattus norvegicus and R. rattus in Kermanshah, west of Iran. Thus T. muris was the most prevalent and S. muris the least abundant (9). In another study, parasitic infection was observed in Rhombomys opimus in Golestan, adjacent Province to North Khorasan Province. The most prevalent helminth species in this study was Dipetalonema (Acanthocheilonema) viteae (10). Eleven helminths were isolated from Apodemus sylvaticus and M. musculus in Hamadan, west of Iran (11). Furthermore, 9 genera or species of the endoparasites were reported in Tatera indica, Meriones hurriana, Gerbilus nanus and Meriones libycus in Sistan and Baluchistan Province, southeast of Iran (12).

Although some investigations have been carried out on rodent parasites in Iran, there is still paucity of data regarding the parasites of rodents in northeast of Iran. This study aimed to investigate helminth infections among rodents of North Khorasan Province, northeast of Iran with 36°42' to 38°14'N and 56°03' to 58°03'E (Fig. 1). The total area was approximately 28,179 km².

Rodent collection and Methods

The samples, which included rodent carcasses, were provided after an assessment of rodent fauna in North Khorasan Province as part of another research project carried out in Vector-borne diseases research center, Bojnurd, Iran (13). The specimens were collected using different methods including kill and live traps, digging of their burrow, filling of their hiding places with water and hand net. ArcGIS ver. 9.3 software was applied for the preparation of the map of sample localities.

Isolation of parasitic worms from rodent intestines

Rodents were anesthetized and killed by chloroform inhalation. The parasites were isolated from rodent intestines. At necropsy, their alimentary canals were removed and the contents of each part were washed in the laboratory, and the lining membrane of intestines was gently scraped with a scalpel's blade and the contents were examined under a stereo microscope. The large worms were collected from the washed materials.

The parasites were transferred to School of Public Health, Tehran University of Medical Sciences for parasites identification. Cestodes were stained with carmine acid and the nematodes were cleared in lactophenol and were identified based on morphological characteristics (14). The rodents were identified in Rodentology Research Department (RRD), Ferdowsi University of Mashhad, Iran.

Ethical statement

Specimens' collection was performed in accordance with the procedures approved by the Ethical Committee of North Khorasan University of Medical Sciences.

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Fig. 1: Geographical location and localities of the sampled rodents under investigation for intestinal helminths infection in North Khorasan Province, Iran, from 2011-2013

Results

One hundred and thirteen rodents belonging to thirteen species were captured. The microscopic examination of gastrointestinal tract contents revealed the presence of thirteen species of different helminths. Fifty-eight specimens were observed which carry one or more helminth species, resulting in a prevalence of 51.3% (Table 1).

Table 1: Frequency of necropsied and infected rodents with intestinal helminths in North Khorasan Province, Iran from 2011-2013

| Species                | Number of necropsied | Number of infected | Infection percent |
|------------------------|----------------------|--------------------|-------------------|
| *Mus musculus*         | 10                   | 7                  | 70.0              |
| *Apodemus witterbyi*   | 7                    | 2                  | 28.6              |
| *Meriones persicus*    | 24                   | 14                 | 58.3              |
| *Meriones libycus*     | 13                   | 7                  | 53.8              |
| *Nesokia indica*       | 18                   | 10                 | 55.6              |
| *Microtus paradoxus*   | 3                    | 0                  | 0.0               |
| *Dryomys nitidula*     | 4                    | 0                  | 0.0               |
| *Allactaga elater*     | 13                   | 8                  | 61.5              |
| *Calomyscus elburzensis* | 4                  | 3                  | 75.0              |
| *Calomyscus mistax*    | 3                    | 1                  | 33.3              |
| *Rhombohyas optimus*   | 11                   | 4                  | 36.4              |
| *Ellobius fuscoapillus*| 1                    | 1                  | 100.0             |
| *Cricetulus migratorius* | 2                | 1                  | 50.0              |
| **Sum**                | **113**              | **58**             | **51.3**          |
The most diversified parasites were detected in *M. persicus* (Table 2). The high percentage of infection was found in *Calomyscus elburzensis* (75%), *M. musculus* (70%) and *Allactaga elater* (61.5%), respectively. In addition, *S. obvelata* were found in one *Ellobius fuscocapillus*.

*S. obvelata* and *A. tetraptera* were more frequent and *P. Seurat* (Fig. 2), *R. ratti* (Fig. 3 (A)) and *C. fasciolaris* (Fig. 3(B)) were found only in one specimen. The rest of the helminths parasites belong to, *H. diminuta*, *N. brasiliensis* (Fig. 3(C,D)), *S. lobata*, *S. kuntzi*, *T. taeniaeformis*, *T. muris*, *Acanthocephal. spp* and *Trichuris spp*.

Fig. 2: Anterior ends of *P. Seurat* with lips and papillae

Fig. 3: (A) *Rictulariaratti*; anterior end shows anterior combs (B) *Cysticercus fasciolaris* (C, D) Spiral shape of *Nippostrongylus brasiliensis* (Original)
Table 2: Frequency of infected rodents with different intestinal helminths in North Khorasan province, Iran from 2011-2013

| Species of rodents | Number of infected rodents | Species of helminths |
|--------------------|---------------------------|----------------------|
|                    |                          | cysticercus fasciolaris | Ricardia ratti | Proteocephalus brasiliensis | Nippostrongylus brasiliensis | Taenia taeniaeformis | Syphacia obvelata | Streptopharagus kuntzi | Hymenolepis diminuta | Trichuris muris | Trichuris spp. | Acanthocephala spp. | A. tetraptera | A. lobata | Apodemus witherbyi |
| Mus musculus       | 7                         | +                     | +             | +                           | +                           | +                     | +                         | +                     | +                           | +                     |
| Apodemus witterbyi | 2                         | +                     |               |                              |                              | +                     |                           | +                     |
| Meriones persicus  | 14                        | +                     | +             | +                           | +                           | +                     | +                         | +                     | +                           | +                     |
| Meriones libycus   | 7                         | +                     | +             | +                           | +                           | +                     | +                         | +                     | +                           | +                     |
| Nesokia indica     | 10                        | +                     | +             | +                           | +                           | +                     | +                         | +                     | +                           | +                     |
| Micrornis paradoxus| 0                         |                       |               | +                           | +                           | +                     |                           | +                     |
| Dryomys nitidula   | 0                         |                       |               | +                           | +                           | +                     | +                         | +                     |
| Allactaga elater   | 8                         | +                     |               |                              | +                           | +                     |                           | +                     |
| Calomyscus elburzensis | 3                | +                     |               |                              | +                           | +                     |                           | +                     |
| Calomyscus mistax  | 1                         | +                     |               |                              | +                           | +                     |                           | +                     |
| Rhombomys opimus   | 4                         | +                     | +             | +                           | +                           | +                     |                           | +                     |
| Ellobius fuscocapillus | 1                | +                     |               |                              | +                           | +                     |                           | +                     |
| Crictetus migratorius | 1                | +                     |               |                              | +                           | +                     |                           | +                     |

Discussion

This study is reporting intestinal helminths from A. elater, E. fuscocapillus, C. elburzensis and Calomyscus mistax species for the first time in this part of Iran. In general, 51.3% of the rodents were infected with at least one helminth species.

The highest rates of parasitic infection were seen in C. elburzensis (75%), M. musculus (70%) and A. elater (61.5%). However, parasitic infections were not found in Microtus paradoxus and Dryomys nitidula.

Considering the variation of parasites, eight species of helminth were found in M. persicus. R. ratti and S. lobata were seen in M. persicus for the first time in Iran. The result of the present study showed that this rodent species was infected with S. obvelata, T. muris, H. diminuta, Trichuris spp., C. fasciolaris and Acanthocephala spp. This result is similar with those of previous studies in Iran (8, 11).

Several researchers have isolated Trichuris spp., S. obvelata, S. lobata, A. tetraptera and Acanthocephala spp. from Meriones lybicus in different parts of Iran (8, 15). In this study, N. brasiliensis and S. kuntzi were seen in Meriones lybicus for the first time in Iran.

S. obvelata, A. tetraptera, Acanthocephala spp., S. kuntzi, T. taeniaformis and N. brasiliensis were reported in Nesokia indica for the first time in Iran. S. obvelata was reported in N. indica using histopathology method (16).

This study reported S. kuntzi in Rhombomys opimus for the first time in Iran. S. obvelata, A. tetraptera and S. lobata have been reported previously (10).

In M. musculus three species of helminth were found: S. obvelata, A. tetraptera and P. Seurat. Beside, this study is the first to report P. Seurat in this species in Iran. In Kermanshah and Hamadan provinces, west of Iran, S. obvelata was previously isolated from this species (9, 11). S. obvelata was isolated from M.
musculus in Ahvaz city southwest of Iran (7). However, this rodent species had no parasitic infection in Tabriz city, northwest of Iran (17). In Brazil and Chile, S. obvelata and A. tetraptera were found in M musculus (18, 19). Researchers have also demonstrated S. obvelata in M. musculus in Korea (20).

Endoparasites were reported in Cricetulus migratorius of Tabriz city. In present study, we also isolated A. tetraptera from this rodent species (21).

T. muris and S. obvelata were observed in Apodemus witterbyi for the first time in Iran. In Khorasan Razavi Province, Echinococcus multilocularis infection was identified in this species (22), but in present study, this parasite could not be determined. The difference of this result is because in the first study, in addition to intestinal helminths, parasites of liver were studied using molecular method.

The species of rodents, such as M. paradoxus, A. elater, C. elburzensis, E. fuscoapillus, C. mistax and D. nitedula, were observed in North Khorasan Province. The following helminths were found in the above listed rodent species, with the exception of M. paradoxus and D. nitedula, for the first time in Iran: S. obvelata in Ellobius fuscoapillus, H. diminuta, A. tetraptera, S. obvelata and T. taeniaeformis in A. elater, A. tetraptera and S. obvelata in C. mistax, and S. obvelata in C. elburzensis. Besides, Syphacia spp. was found in E. fuscoapillus in Afghistan (23). S. obvelata and T. taeniaeformis were isolated from A. elater in Mongolia, which is in line with the results of this study (5).

Conclusion

Understanding of rodent parasitic fauna in different zoogeographical regions can fill the gap of information concerning the possible potentials for transmission of zoonotic helminthes to humans in the given areas. Northeastern Iran is a region with unanswered questions upon the issue. Since long time ago, the study of parasitic fauna in rodents in North East of the country has been always an attracting subject to parasitologists interested to recognize the role of rodents in zoonotic infection transmission. Further studies are required to answer some other remained questions including seasonal prevalence of each helminth, and to determine the role of paratenic and intermediate hosts involved in the lifecycle of our reported parasites. Thirteen species of parasites have been naturally found in the captured rodents in this part of Iran.

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