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Iranian J Parasitol

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Iranian Society of Parasitology
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Original Article

Helminth Infections in *Rattus ratus* and *Rattus norvegicus* in Tehran, Iran

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Received 23 Mar 2014
Accepted 10 Aug 2014

Keywords:
Helminthes,
Rodent,
Rattus ratus,
Rattus norvegicus,
Iran

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Abstract

Background: The aim of this study was to determine intestinal and liver helminth infections in *Rattus* rodents in Tehran Iran.

Methods: Overall, 306 traps were put in 39 different regions in Tehran from 2009 to 2010. Rodents, including *R. ratus* and *R. norvegicus* were caught by live-traps. They become unconscious and the spinal cords were cut, afterwards the body was dissected and the stomach, small intestine, large intestine, liver, and cecum were studied separately. The dominant type and the prevalence rate of parasites in the rodents were determined based on the infected parts of their body.

Results: After recognition of the helminthes' types, among the 120 total number of rodents, 39 belonged to males, while among the infected rodents, 57(47.5%) were female and 18(15%) were male. The prevalence of infection in Tehran was 62.5%. Seventy cases (58.33%) of helminth infections were observed in *R. ratus* and 5 cases (4.16%) were observed in *R. norvegicus*. The maximum prevalence (15.5%) was seen in the center and east part of Tehran, while the minimum (9.16%) was in the north part of the city. The helminthes types and the corresponding percentages were *Hymenolepis nana fraterna* (35.8%), *Heterakis spumosa* (17.5%), *Hymenolepis diminuta* (7.5%) and *Capillaria annulosa* (1.6%). The dominant rodent was *Rattus ratus* and among the identified helminthes, *Hymenolepis diminuta* and *Hymenolepis nana fraterna* are zoonotic ones.

Conclusion: The information presented here improves our understanding of the major parasitic infections that rodents harbor and can transmit to human and animal populations in Iran. To prevent infectivity of human, the hazard of the identified zoonotic species needs to be contemplated.

Introduction

Rodents constitute the largest and most successful group of mammals worldwide. They have a high rate of reproduction, are cosmopolitan in distribution and have the ability to adapt to a wide variety of habitats (1). Many rodents can spread diseases to humans and domestic animals (2). Rodents can infect humans through various ways, among which, rodent excrement, ingesting food contaminated with rodent's fur, feet, urine or fecal dropping are the most serious one. Besides, endoparasitic agents, which can be very serious in human and livestock health, are mostly homed by wild rodents (3, 5).

Survey the parasites of rats for detection the source of zoonotic infections is important, because they can be reservoir of the serious zoonotic parasitic infections (6). To prevent the consequences of disease transmission to humans and animals, exploring rodents' parasites in various places seems crucial (7).

The development of control methods against zoonotic parasites is dependent on knowledge of their life cycles and transmission pattern in each zoogeographical condition (8). *Hymenolepis nana* and *H. diminuta* are commonly found in rats and mice and potentially transmissible to human (9). There are some reports on the occurrence of parasitic infection in different species of rodents in some areas such as Tehran, Ahwaz, Meshkin shahr, Northen Isfahan, Bandar Abbas, Dasht e Moghan and Minab (8 -18).

The present study is the first one, which is on the prevalence of *Rattus'* parasitic helminthes in Tehran, Iran.

Materials and Methods

Teheran is the capital of Iran with a population of around 8.3 million and surpassing 14 million in the wider metropolitan area, Tehran is Iran's largest city, and one of the largest cities in West Asia. Tehran features a semi-arid,

continental climate. The northern parts can reach a Mediterranean climate (Csa) bordering humid continental (Dsa). Tehran's climate is largely defined by its geographic location, with the towering Alborz Mountains to its north and the central desert to the south. It can generally be described as mild in the spring and autumn, hot and dry in the summer, and cold in the winter.

In this prospective study, Tehran was divided into 5 areas (North – South – Center – East – West) and 306 live traps were set at outdoor places in parks and dry riverbeds in 39 locations during or among Jun 2009 to March 2010. The traps were set each afternoon and were collected next early morning.

Rodents were trapped using metallic live traps with different baits such as fresh cucumber, cheese and walnut. (Havahart or Longworth models). Then trapped rodents were transferred to Parasitology Laboratory, School of Medical Science, Tarbiat Modares University in Tehran, and morphological characteristics of each rodent and their sex were registered by using valid identification key (19).

Rodents were anaesthetized with diethyl ether then were euthanized. After dissection, impression smears were prepared from liver and spleen. Different organs of each rodent were removed including the liver, small and large intestine and reproductive tract and examined under stereomicroscope for the presence of parasites. Livers with *Cysticercus fasciolaris* parasitic larva cysts were collected in normal physiological saline, and then the numbers and dimensions of the cysts were recorded.

To study the morphology of larvae for identification purposes, the cysts were opened via a small slit to release the parasites. The length of the larvae was also measured. To collect parasites from the intestine, the intestinal contents were transferred to several large Petri dishes containing saline solution. These larvae

and other parasites were collected and preserved in 10% formol-saline for later identification after applying specific clearing and staining techniques with Azocarmine in lactophenol, the parasites were identified using appropriate systematic keys (20), the worms recovered were examined by Azocarmine staining (20-22). Measuring and drawing was done with drawing tube and measuring optical lens.

Statistical methods

Analyses of all variable were computed using Chi-square test and $P < 0.05$ was expected significant.

Results

A total of 120 rodents were captured including two species; 104 (86%) *R. rattus* and 16 (14%) *R. norvegicus*. Therefore, the most abundant species in the present study was *R. rattus*. More female were captured than males. This is probably because of females repeatedly gone out from the nests to gain more food during pregnancy and lactating, so they are more vulnerable to be trapped than males. The central and east of Tehran had the highest infection rate (15.5%) while the north had the lowest (9.16%). All two rodent species were naturally infected with one or more species of helminthes. Out of the 104 *R. rattus* and 16 *R. norvegicus* individuals examined, the rate of infection was highest in *R. rattus* (58.33%) then *R. norvegicus* (4.16%). In this study, The *Hymenolepis nana* had the highest infection rate (35.8%) and the lowest infection was the *Capillaria annulosa* (1.7%).

A total of 120 rats (41 males and 79 females) were captured and examined. Infection was found in 75 rats (62.5%) that were 47.5% and 15% in female and male. Five different helminthes were identified: *H. nana* (35.8%), *Heterakis spumosa* (18.3%), *Cysticercus fasciolaris* (18.2%), *H. diminuta* (7.5%) and *C. annulosa* (1.7%). Statistical analysis showed a non significant association between prevalence of hel-

minthes infection and host sex and maturity ($P=0.35$).

Statistical analysis did not show a significant association between prevalence of helminth infection and area ($P=0.29$).

Discussion

Helminth life cycles can play an important role in the ability of a species to colonize in new habitats (23). The present study increased our knowledge about the prevalence of helminthes in urban rodents in Tehran.

A total of 5 helminth parasite species were identified from two taxonomic groups. They were Cestodes (*H. nana*, *H. diminuta* and *C. fasciolaris*) and Nematodes (*Heterakis spumosa* and *Capillaria annulosa*).

The prevalence and intensity of each species of helminth parasites were varied greatly from one another, but there was no statistical difference between male and female for infectivity with parasites (7).

The rodent species examined in this study were *R. rattus* and *R. norvegicus*. Two of the recovered parasites from the rodents in this study were zoonotic importance helminthes, including *H. nana* and *H. diminuta*. *H. nana* is the zoonotic helminth commonly reported in Iran (24). The high prevalence of *H. nana* (35.8%) infections in our study may probably be due to availability of the parasites to rats. Since most of the rats feed and live within a small area, infections are easily maintained among the population. The prevalence rate of 35.8% of *H. nana* infection in the urban rats in this study poses a health risk to human.

H. diminuta has already been reported in human as well. This parasite is common in children and sometimes produces disorders in the hosts. The highest prevalence rates of human infections in Iran have been reported in the rural areas of Minab (14). There are rare reports of human infections with *C. fasciolaris* (24). These zoonotic parasites have been also reported from rodents in variable prevalence

of different areas worldwide such as Siberia (25), Switzerland (26) and Iran (18), Nigeria (27), Philippines (28), Italy (29), Bangladesh (30).

C. fasciolaris, the larval stage of *T. taeniaeformis*, is a common parasite of rodents and, its occurrence in laboratory and wild rodent species has been reported in some studies (10, 13, 29).

H. spumosa is a typical parasite of the genus *Rattus*. The helminth has been reported from Sicily, Italy (29), Dezful, Iran (10), Bangladesh (30), in laboratory mice (31-33) and Kerman-shah, Iran (34). There was no major difference in the infection rate among the males and females in this study.

Conclusion

The information presented here improves our understanding of the major parasitic infections that rodents harbor and can transmit to human and animal populations in Iran, abundance of beetles and fleas has led to a wide variety of those parasites utilizing arthropods as vector or intermediate host in their indirect life cycles. In this study, *R. ratus* was the predominant rodent species infected with 5 different parasites two of which are zoonotic. The possibility of these rats contaminating the environment, food and water source with their parasites poses a public health threat since these rats live in close association with humans. Rodent control, along with surveillance and monitoring local area problems, is targeting at minimizing human and domestic animal exposure to the plausible rodent infections. Moreover, the mentioned factors can also help prevent the rodent-borne diseases.

Acknowledgments

Hereby we would sincerely like to thank the research office of Medicine Faculty of Tarbiat Modarres School of Medical Science University and the Research Office of Baqyatallah University of Medical Sciences because of

their true support. The authors declare that there is no conflict of interests.

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