





Research Article

Prevalence of Parasitic Intestinal Infections in livestock in Kalat, Iran

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ABSTRACT

Introduction: Rodents are the largest group of mammals and act as a reservoir for many common human diseases, leading to societal health and economic problems. Due to the different prevalence rates of rodent-borne parasitic infections in various regions, this study was conducted to determine the prevalence of intestinal parasites in wild and domestic rodents in Kalat County, located in the north of Khorasan Razavi Province, Iran, in 2016.

Materials and methods: The study was performed using a descriptive method on 86 mountainous and domestic rodents randomly caught using live traps. After anesthesia and species identification, the gastrointestinal tract was dissected, and the digestive system worms were separated and preserved in 10% formalin until identification. The nematodes were clarified with lactophenol and stained with carmine acid. All worms were identified using diagnostic keys, and the results were presented using descriptive statistics.

Results: The prevalence of gastrointestinal worm infections in rodents in the study area was 75.5%. The captured rodents in this area included *Microtus* (53.4%), *Mus musculus* (17.4%), *Pikas* (15.1%), *Apodemus agrarius* (12.7%), and *Allactaga elater* (1.1%). Six species of nematodes and one cestode species were identified in this study. The prevalence of parasitic infections shared between humans and rodents included *Syphacia obvelata* (83%), *Aspicularis tetraptera* (18.5%), *Trichuris fossor* (16.9%), *Hymenolepis nana* (6.1%), *Heligmosomoides polygyrus* (10.7%), and *Nippostrongylus braziliensis* (1.5%). *Capillaria* spp were found in 1.5% of rodents.

Conclusion: The results revealed a high prevalence of gastrointestinal worm infections in rodents, with an overall prevalence rate of 75.5% in Kalat, Iran. These findings highlight the potential health risks associated with rodent-borne parasitic infections in the study area and emphasize the importance of implementing effective control and prevention measures to mitigate the impact on human health and the local economy.

1. Introduction

Rodents are fascinating creatures that have adapted to various environments and play essential roles in many ecosystems¹. They are found on every continent except Antarctica, and their populations can range from a few individuals to millions. Rodents belong to the largest order of mammals, Rodentia, and are known for their distinctive incisors that grow continuously throughout their lives². While rodents are generally harmless, they can pose significant public health and economic challenges in communities where they are prevalent³. They are

notorious for carrying and transmitting various diseases to humans and other animals. Large rodents like beavers, porcupines, and capybaras harbor zoonotic diseases that can infect humans⁴. Additionally, rodents can carry parasitic infections leading to significant health problems in humans and other animals⁵.

Intestinal helminths are a common type of parasitic infection found in rodents⁶. These parasitic worms live in the intestine of rodents and can cause significant health problems in humans and other animals⁷. Rodents can

become infected with these parasites through various means, including consuming contaminated food or water or contacting contaminated soil or feces⁸. Different species of rodents can carry different types of intestinal helminths. Some of the most common species of intestinal helminths found in rodents include nematodes, cestodes, and trematodes⁹. Nematodes, known as roundworms, are long and slender worms that can grow up to several inches^{10,11}. Cestodes or tapeworms, are long and flat worms that can grow up to several feet in length^{12,13}. Trematodes, also named flukes, are leaf-shaped worms ranging from tiny to several inches long. Intestinal helminths can cause various symptoms in humans and animals, depending on the worm species and the infection's severity¹⁴. The most common symptoms include abdominal pain, diarrhea, vomiting, weight loss, and fatigue¹⁵. In some cases, severe infections can lead to more serious health problems, such as intestinal obstruction or malnutrition¹⁶. Given the potential health risks associated with intestinal helminth infections in rodents, it is essential to understand the prevalence and distribution of these infections in different regions¹⁷. This can help inform public health interventions to reduce the spread of these parasites and improve the health outcomes of affected communities¹⁸.

Given the varying prevalence of parasitic infections in rodents across different regions, a study was conducted in the city of Kalat, located in the northern part of Khorasan Razavi Province, Iran, in 2016 to determine the extent of intestinal parasite infections in the desert and domestic rodents.

2. Materials and Methods

2.1. Ethical approval

All procedures were approved by the Animal Care Committee of Veterinary Medicine, Ferdowsi University, Mashhad, Iran. The principles of laboratory animal care were followed, and specific international laws were observed.

2.2. Study design and location

The study was conducted using a descriptive method, a type of observational study used to describe the prevalence of a specific health condition or disease in a particular population. In this case, the population under study was rodents captured randomly using live traps in Kalat's mountainous and domestic areas.

2.3. Animals

In this study, live traps were used to capture 86 rodents to avoid harming them. Once the rodents were captured, they were anesthetized to prevent unnecessary suffering. Species then identified the rodents, and their digestive tracts were examined to isolate any intestinal worms present.

2.4. Parasites

To isolate the worms, the researchers first preserved them in 10% formalin, a type of solution used to prevent the decay of biological specimens. The worms were then clarified using lactophenol, a type of solution used in microscopy to make it easier to view the internal structures of small organisms. Finally, the worms were stained with carmine acid, a type of stain used in histology to highlight the structures of cells and tissues. All the worms were identified using diagnostic keys, which are sets of criteria used to identify different species of worms based on their physical characteristics. The researchers then analyzed the data using descriptive statistics, which are statistical methods used to describe the characteristics of a dataset. In order to identify cysts, they used a stereomicroscope to examine the base of the cysts and look for protoscolex formations. For cestode parasites, they placed them between two glass slides for a week and then stained them with carmine alum stain after immersing them in 70° ethanol. The stained specimens were dehydrated in ethanol and mounted in Canada balsam to allow for the description of the species and genus of the cestodes. To detect and identify nematodes, they fixed them in 70° ethanol and then cleared them in lactophenol. In this study we were able to determine the species and genus of nematodes based on the morphology of their spicules and mouths.

2.5. Statistical Analysis

All statistical analyses were performed using Microsoft Excel 2023 (Microsoft Corporation, Redmond, WA, USA).

3. Results

The results in the city of Kalat, Iran, showed a high prevalence of gastrointestinal worm infections in rodents in the study area. Specifically, the prevalence of such infections was found to be 75.5%. This is a concerning finding because rodents can transmit various parasites to humans and other animals, leading to significant public health and economic challenges in affected communities. Moreover, *Microtus* (53.4%), *Mus musculus* (17.4%), *Pikas* (15.1%), *Apodemus agrarius* (12.7%), and *Allactaga elater* (1.1%) were identified in the investigated area. These different species of rodents were found to be carrying various types of parasites.

The study also identified several species of nematodes and one cestode species in the rodents captured in the study area. The prevalence of these parasites shared between humans and rodents included *Syphacia obvelata*

Table 1. Numbers of rodents and their species

Rodent species	Number (percentage)
<i>Microtus</i>	46 (53.4%)
<i>Mus musculus</i>	15 (17.4%)
<i>Pikas</i>	13 (15.1%)
<i>Apodemus agrarius</i>	11 (12.7%)
<i>Allactaga elater</i>	1 (1.1%)
Total	86 (100%)

Table 2. The prevalence of the rodents parasites

Parasite	Infection percentage
<i>Syphacia obvelata</i>	(83%)
<i>Aspicularis tetraptera</i>	(18.5%)
<i>Trichuris fossor</i>	(16.9%)
<i>Hymenolepis nana</i>	(6.1%)
<i>Heligmosomoides polygyrus</i>	(10.7%)
<i>Nippostrongylus braziliensis</i>	(1.5%)
<i>Capillaria</i> spp	(1.5%)

(83%), *Aspicularis tetraptera* (18.5%), *Trichuris fossor* (16.9%), *Hymenolepis nana* (6.1%), *Heligmosomoides polygyrus* (10.7%), and *Nippostrongylus braziliensis* (1.5%). These parasitic infections in rodents indicate the potential for transmission to humans and other animals in the region.

Additionally, the study found *Capillaria* spp in 1.5% of rodents. *Capillaria* spp are known to cause various animal health problems, including gastrointestinal symptoms and even death in severe cases.

4. Discussion

The prevalence of rodent-borne parasitic infections is a significant concern for human health and the economy¹⁹. This study aimed to investigate the prevalence of intestinal parasites in wild and domestic rodents in Kalat County, located in the north of Khorasan Razavi Province, Iran. The study used a descriptive method on 86 rodents captured randomly using live traps. The study's results indicated that the prevalence of gastrointestinal worm infections in rodents in the study area was 75.5%. This high prevalence rate highlights the potential health risks of these parasites and emphasizes the need for control measures.

The study also identified six species of nematodes and one cestode species in the captured rodents. The prevalence of parasitic infections shared between humans and rodents included *Syphacia obvelata*, *Aspicularis tetraptera*, *Trichuris fossor*, *Hymenolepis nana*, *Heligmosomoides polygyrus*, and *Nippostrongylus braziliensis*. This finding is particularly noteworthy because these parasites can cause various human diseases, including gastrointestinal disorders, and highlights the risk of transmission between rodents and humans^{5,20,21}. The obtained results revealed that the captured rodents belonged to five species, including *Microtus*, *Mus musculus*, *Apodemus*, *Abadamus*, and *Aegialomys*. This information is useful for understanding the potential distribution of these parasites in the study area and for designing appropriate control measures based on the specific rodent species present.

The results of this study are significant because they provide important information about the prevalence of rodent-borne parasitic infections in a specific geographic area. This information can help to guide public health efforts and control measures to prevent and reduce the transmission of these parasites to humans and animals. The study also highlights the need for continued research to understand better the distribution and prevalence of these parasites in different regions and identify effective control measures to reduce their impact on human and

animal health. Overall, this study provides important insights into the prevalence and distribution of gastrointestinal parasites in rodents in the study area. The high prevalence of these parasites highlights the need for ongoing surveillance and control measures to prevent the spread of these parasites and reduce their impact on public health and the economy. The prevalence of intestinal parasites identified in the study is a significant public health concern for the residents of Kalat County, especially those in rural areas with a higher likelihood of interacting with rodents. The high prevalence of gastrointestinal worm infections in rodents is alarming, as it can spread these parasites to humans, resulting in significant health problems²². These parasites can cause a wide range of symptoms, including diarrhea, abdominal pain, anemia, and malnutrition²³⁻²⁵. Furthermore, some of these parasites, such as *Hymenolepis nana*, can potentially cause chronic infections that can lead to long-term health complications²⁶.

Identifying shared parasitic infections between humans and rodents is of particular concern, as these parasites can easily be transmitted to humans through contact with rodent feces or urine. The high prevalence of *Syphacia obvelata*, a species of pinworm, in both rodents and humans, highlights the potential for transmission of this parasite between the two groups²⁷. This finding is especially concerning given that pinworm infections are often asymptomatic, making it difficult to detect and control the spread of these parasites. Identifying multiple nematode species in the study area is also noteworthy, as some species, such as *Heligmosomoides polygyrus* and *Trichuris* spp, have been linked to chronic human infections^{28,29}. These infections can lead to long-term health complications, including malnutrition, anemia, and impaired cognitive function, particularly in children³⁰. The high prevalence of these nematodes in the rodent population suggests that there may be an increased risk of transmission to humans in the study area.

5. Conclusion

Overall, the study conducted in Kalat County, Iran, highlights the critical role of comprehensive surveillance, effective control measures, and public awareness in reducing the transmission of gastrointestinal parasites from rodents to humans. The findings contribute to the growing body of knowledge on parasitic infections and provide a foundation for future research and interventions aimed at safeguarding human health.

Declarations

Competing interests

The authors have declared no conflicts of interest.

Authors' contributions

Nona Moradpour and Hassan Borji were responsible for the conceptualization of the study, while Nona Moradpour

and Mir Asadollah Amiri developed the methodology. Formal analysis and investigation were also carried out by Nona Moradpour Mir Asadollah Amiri. Nona Moradpour and Hassan Borji provided supervision throughout the project. All authors participated in the writing of the original draft and subsequent review and editing of the manuscript. Finally, all authors have reviewed and approved the final version of the manuscript for publication in the present journal.

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Ethical considerations

The authors declare that this manuscript is original and has not been submitted elsewhere for possible publication. The authors also declare that the data used/presented in this manuscript has not been fabricated.

Availability of data and materials

The data presented in this study are available on request from the corresponding author.

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