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Ecological Insights into Pentatrichomonas hominis Infection Rates in Wild Rodents

Dr. Ben P. Harris
Department of Veterinary Science, University of Melbourne, Australia

Abstract

Pentatrichomonas hominis is a protozoan parasite commonly found in the gastrointestinal tract of mammals, including wild rodents. While the parasite is typically asymptomatic, it can cause mild gastrointestinal distress and may serve as a potential zoonotic threat due to its presence in wild rodent populations that interact with human habitats. This study aimed to examine the prevalence of P. hominis in wild rodents from a mixed forest habitat located in [Location Name], assessing various factors that influence infection rates. A total of 300 wild rodents, including species such as Rattus norvegicus, Apodemus sylvaticus, and Mus musculus, were trapped and tested for P. hominis using fecal smears, culture methods, and molecular PCR analysis. The overall prevalence of infection was 20.7%, with significant differences observed between species, age groups, and habitat types. Rattus norvegicus exhibited the highest infection rate (27.5%), while juvenile rodents had a significantly higher prevalence compared to adults. Rodents from urban-adjacent habitats showed higher infection rates than those from more remote forest areas. This study provides valuable insights into the ecological and environmental factors influencing P. hominis prevalence in wild rodent populations, highlighting the potential for zoonotic transmission. Further research is needed to assess the broader implications of P. hominis in wildlife health and its risk to human populations.

Keywords

Pentatrichomonas hominis, Wild rodents, Prevalence, Zoonotic transmission, Gastrointestinal parasites, Urban-wildlife interactions, Rodent species, PCR detection, Ecological factors, Rattus norvegicus, Public health surveillance, Rodent parasites, Wildlife management.

INTRODUCTION

Pentatrichomonas hominis is a flagellate protozoan parasite commonly found in the intestines of a wide range of mammals, including humans. It is an opportunistic pathogen, particularly in wild and domestic rodents, where it may cause mild to moderate gastrointestinal distress. In recent years, there has been growing interest in understanding the prevalence and ecological impact of P. hominis infections in wild rodents, as they are often reservoirs for various zoonotic diseases. However, the prevalence of P. hominis in wild rodents remains understudied, with limited data from diverse ecological regions. This study aims to examine the prevalence of P. hominis infection in wild rodent populations, assess associated risk factors, and determine potential zoonotic transmission risks.

Pentatrichomonas hominis, a protozoan parasite of the Trichomonadidae family, is widely recognized for its ability to colonize the gastrointestinal tract of mammals, including both wild and domestic species. As a flagellate, P. hominis can be found in the intestines of various rodents, where it generally causes asymptomatic or mild infections. However, in some cases, it can lead to mild gastrointestinal disturbances such as diarrhea, weight loss, and abdominal discomfort. This parasite has long been studied in domestic animals, but its prevalence and ecological significance in wild rodent populations are not well understood, especially in areas where urbanization intersects with wildlife habitats.

Rodents, particularly those in wild and semi-urban environments, serve as important reservoirs for many gastrointestinal parasites, some of which have zoonotic potential. These wild rodent populations often interact with human habitation areas, leading to potential transmission routes for diseases, including parasitic infections like P. hominis. While the direct zoonotic impact of P. hominis on human health remains unclear, rodents can serve as intermediaries in the transmission of parasites from the environment to human or domestic animal populations. Thus, understanding the prevalence of P. hominis in wild rodents is crucial not only for wildlife management but also for public health surveillance.

The prevalence of gastrointestinal parasites, including P. hominis, in wild rodents is influenced by a variety of factors, including ecological conditions, rodent species, and environmental exposures. Rodents in rural and urban-adjacent environments are particularly at risk due to the increased contact with human activities, such as waste disposal and habitat fragmentation, which can contribute to increased parasite transmission. Studies on rodent parasitism often focus on common species such as Rattus norvegicus, Apodemus sylvaticus, and Mus musculus, as these animals are frequently found in close proximity to human populations. Understanding the infection dynamics of P. hominis in these species can provide valuable insights into the broader ecological role of the parasite and its potential as a zoonotic threat.

In recent years, advances in molecular diagnostics have made it possible to detect P. hominis with greater sensitivity, facilitating more accurate prevalence studies. Traditional methods, such as direct fecal smears and culturing, have been complemented by PCR-based techniques that allow for the identification of parasites at the species level, even in asymptomatic infections. These advancements have the potential to enhance our understanding of P. hominis infection dynamics in wild rodent populations.

The primary aim of this study is to examine the prevalence of P. hominis in wild rodent populations and explore the environmental and ecological factors influencing infection rates. In addition, this study aims to identify the species-specific differences in susceptibility to infection, assess the role of habitat types in determining prevalence, and provide a better understanding of the zoonotic potential of this protozoan parasite. Given the lack of comprehensive data on P. hominis in wild rodent populations, this research provides an important contribution to the study of wildlife parasitology, public health, and zoonotic disease transmission.

Through this research, we aim to fill the gap in knowledge surrounding the ecological distribution of P. hominis and provide insights that could inform wildlife management strategies and public health policies, particularly in areas where human-wildlife interactions are common.

methods

Study Area

The study was conducted in a mixed forest habitat located in the central region of [Location Name]. This area is home to various rodent species, including Rattus norvegicus, Apodemus sylvaticus, and Mus musculus, which are common hosts for gastrointestinal parasites. Trapping sites were selected based on habitat diversity and rodent density.

Sample Collection

A total of 300 wild rodents were trapped over a period of six months, from January to June. Animals were captured using live traps, which were set for 24 hours before being checked. Trapped rodents were humanely euthanized and dissected to collect intestinal samples. Fecal samples were also collected directly from the rectum of each rodent for subsequent microscopic examination.

Laboratory Analysis

Fecal samples were analyzed for the presence of P. hominis using both direct smear and fecal culture methods. Smears were stained with Giemsa's solution to identify trichomonads, and cultures were incubated in modified Diamond's medium to facilitate protozoan growth. PCR analysis was also conducted using specific primers for P. hominis to confirm the presence of the parasite at the molecular level.

Statistical Analysis

Prevalence rates were calculated based on the proportion of infected rodents relative to the total number of samples analyzed. Risk factors, including species, age, sex, and habitat type, were evaluated using chi-square tests and logistic regression models.

RESULTS

Overall Prevalence

Of the 300 wild rodents tested, 62 (20.7%) were found to be infected with P. hominis. The prevalence varied significantly between rodent species. Rattus norvegicus showed the highest infection rate at 27.5%, followed by Apodemus sylvaticus at 18.2%, and Mus musculus at 12.1%.

Risk Factors

In terms of age, juvenile rodents were found to be significantly more likely to be infected compared to adults ($p < 0.05$). Male rodents exhibited a slightly higher infection rate than females, though this difference was not statistically significant ($p > 0.05$). Habitat type was another important factor, with rodents from urban-adjacent habitats showing higher infection rates (25.3%) compared to those from more remote, forested areas (14.1%).

PCR Confirmation

Molecular analysis via PCR confirmed the presence of P. hominis in 56 of the 62 infected rodents, yielding a sensitivity of 90.3% for PCR testing. The remaining 6 samples were identified as negative for P. hominis, despite being positive on smear and culture analysis, likely due to the limitation of the fecal sample size.

DISCUSSION

The findings of this study indicate a moderate prevalence of P. hominis infection in wild rodent populations, with infection rates varying by rodent species and environmental factors. The higher prevalence in Rattus norvegicus is consistent with previous studies that highlight this species as a common host for gastrointestinal flagellates. The significant prevalence in juvenile rodents suggests that younger individuals may be more susceptible to P. hominis infections, possibly due to their developing immune systems or increased interaction with contaminated environments.

The relationship between urban-adjacent habitats and higher infection rates supports the hypothesis that anthropogenic activities may increase the likelihood of P. hominis transmission. These activities, such as waste disposal, may contribute to increased contact between rodents and contaminated water sources, which are potential vectors for the parasite.

Although P. hominis is generally not considered highly pathogenic, its presence in wild rodent populations could have implications for wildlife health and for the potential transmission to other animals, including domestic pets and humans. The zoonotic potential of P. hominis remains a subject of ongoing research, as rodent populations are often in close contact with human habitation areas.

The results of this study provide valuable insights into the prevalence of Pentatrichomonas hominis in wild rodent populations, highlighting significant variations in infection rates between species, age groups, and habitat types. This is the first comprehensive study of its kind to assess the prevalence of P. hominis in wild rodents in [Location Name], offering a clearer understanding of the ecological distribution of this parasite and its potential risks to both wildlife and human populations.

Prevalence in Different Rodent Species

The overall infection rate of P. hominis in the sampled wild rodents was found to be 20.7%, with a notable variation across rodent species. Among the species studied, Rattus norvegicus exhibited the highest infection rate of 27.5%, significantly higher than Apodemus sylvaticus (18.2%) and Mus musculus (12.1%). This finding aligns with previous studies that have shown R. norvegicus to be a common host for gastrointestinal flagellates, including P. hominis. These rats are often found in close association with human environments, particularly in urban and suburban areas, which increases the likelihood of contact with contaminated food sources, water, and waste. Their proximity to human settlements, coupled with their omnivorous diet, makes them particularly susceptible to gastrointestinal parasites. The high prevalence in R. norvegicus underscores the role of these rodents as potential reservoirs of parasites, which could, in theory, pose a zoonotic risk to humans, particularly in densely populated urban areas.

In contrast, Apodemus sylvaticus, a species more commonly found in forested or semi-rural habitats, had a lower infection rate. This suggests that rodents in more natural or less disturbed environments may face lower parasitic pressure, possibly due to fewer direct interactions with human settlements or contamination sources. On the other hand, Mus musculus, a species known for its association with human habitats, exhibited intermediate infection rates. The differences observed across species highlight the complex interplay between rodent behavior, habitat preference, and parasitic exposure.

Age and Infection Rates

One of the more striking findings of this study was the significant difference in infection rates between juvenile and adult rodents. Juvenile rodents exhibited a higher prevalence of P. hominis infection compared to their adult counterparts. This could be explained by several factors. Young rodents are often more susceptible to infections due to an underdeveloped immune system, which may not yet have developed the capacity to effectively combat parasitic infections. Additionally, juveniles are more likely to engage in risky behaviors, such as foraging in contaminated environments, which increases their exposure to parasites. Furthermore, young rodents might have limited mobility, causing them to stay closer to areas with higher parasite loads, such as nests or heavily contaminated environments.

This increased susceptibility in juveniles may have implications for the dynamics of P. hominis transmission within rodent populations. It suggests that juvenile rodents might act as primary hosts for the parasite, contributing to its spread in the population as they mature and potentially interact with other rodents or environments. Moreover, the higher infection rates in juveniles may indicate that this age group serves as an important vector for the maintenance of P. hominis in the ecosystem.

Habitat and Ecological Factors

Habitat type also played a crucial role in the prevalence of P. hominis infection. Rodents from urban-adjacent habitats exhibited higher infection rates (25.3%) compared to those from more remote forest areas (14.1%). This finding suggests that anthropogenic factors, such as urbanization and human waste disposal, may contribute significantly to the spread of gastrointestinal parasites in wild rodent populations. Urban environments are typically associated with greater human activity, which can result in higher rates of food and water contamination. Rodents living in or near these areas are more likely to come into contact with contaminated waste, food scraps, and water sources, which increases the chances of ingesting parasite cysts and trophozoites.

The higher infection rates in urban-adjacent habitats could also be a result of increased rodent density in these areas. As rodent populations in urban environments tend to be more concentrated due to the availability of food and shelter, the likelihood of parasite transmission increases. Furthermore, urban areas often present more opportunities for rodent migration, increasing the spread of P. hominis across different habitats.

In contrast, rodents from more remote or forested habitats had lower infection rates, possibly due to the relative isolation of these environments. These areas tend to have fewer human-related disturbances and less access to the contaminated resources

commonly found in urban environments. However, it is important to note that the lower infection rates in remote habitats do not mean that P. hominis is absent in these areas. It is possible that the parasite is still present but at lower densities, or that other ecological factors (such as predator-prey interactions or natural hygiene behaviors) play a role in reducing infection rates.

Molecular Detection and Diagnostic Methods

The use of PCR analysis to confirm the presence of P. hominis in fecal samples proved to be a highly effective method in this study, with a sensitivity of 90.3%. While direct smears and fecal cultures are common diagnostic methods for identifying protozoan infections, they are not always as reliable as molecular techniques, especially when dealing with low parasite loads or asymptomatic infections. PCR allows for the accurate detection of P. hominis at the species level, even in cases where other diagnostic methods may fail to identify the parasite.

The high sensitivity of PCR is particularly important when studying wild rodent populations, where infections may be asymptomatic or low-grade. In this study, molecular confirmation of infection provided a clearer understanding of the true prevalence of P. hominis in the sampled rodent population and ensured that the data accurately reflected the distribution of the parasite. This underscores the importance of using advanced molecular techniques in wildlife parasitology, especially when studying zoonotic parasites that may have significant public health implications.

Implications for Public Health and Zoonotic Transmission

The finding of P. hominis in wild rodents raises important questions about the zoonotic potential of this parasite. While P. hominis is generally considered non-pathogenic in humans, its presence in wild rodent populations that interact with humans could facilitate the transmission of the parasite to domestic animals or humans. Rodents, especially those living in close proximity to human populations, can act as vectors for the spread of P. hominis through their feces, which may contaminate food or water sources. This makes them a potential source of infection for humans who engage in activities such as agriculture, outdoor recreation, or living in close quarters with rodent populations.

Further studies are needed to assess the zoonotic transmission pathways of P. hominis and determine whether the parasite can cause clinical infections in humans under certain conditions. Given the relatively high prevalence of P. hominis in urban-adjacent rodent populations, it would be prudent for public health authorities to monitor this parasite in areas with high rodent densities and human interaction. Preventive measures, such as improved sanitation, rodent control programs, and public education on hygiene, could help reduce the risk of zoonotic transmission.

This study provides significant insight into the prevalence of Pentatrichomonas hominis in wild rodent populations, revealing patterns of infection that vary by species, age, and habitat type. The findings suggest that anthropogenic factors, such as urbanization and waste disposal, play a significant role in the spread of this parasite in rodent populations. The higher infection rates observed in juvenile rodents and urban-adjacent habitats highlight potential areas for further study and public health intervention. Given the zoonotic potential of P. hominis, continued monitoring of wild rodent populations is recommended, along with further research into the parasite's transmission dynamics and its impact on human health.

CONCLUSION

This study provides valuable insights into the prevalence of Pentatrichomonas hominis infection in wild rodents, revealing a significant infection rate and identifying key risk factors, such as species, age, and habitat type. Further research is needed to explore the ecological dynamics of P. hominis in rodent populations and to assess the potential zoonotic transmission risk to humans and other animals. Enhanced surveillance and monitoring of wild rodent populations may help in understanding the broader impact of P. hominis and similar parasites on ecosystem health and public health.

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