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Intestinal and Ectoparasites of black rats (*Rattus rattus*) in Garmian, Kurdistan region of Iraq

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Abstract

Rodents are found worldwide and live close to human inhabitation. They are known as vectors of zoonotic diseases such as viral, bacterial and parasitic infections. Investigating parasites of rats and understanding their life cycles have become crucial necessity. The present study aimed to screen for the presence of intestinal parasites and ectoparasites in black rats (*Rattus rattus*) in Garmian region. An overall 55 live rats (21 male, 34 female) were trapped from three districts in Garmian region (Kalar, Kifri and Khanaqin). The rats were euthanized, dissected and their parasites were identified. The overall rate of infection with at least one parasite was 61.81% (36/55). Four genera of nematodes were identified; *Trichuris muris*, *Capillaria sp*., *Strongyloides sp*. and *Trichostrongylus sp*. with infection rate 20% (11/55). Twenty four out of the 55 rats (43.63%) were infected with *Hymenolepis nana* and/or *Hymenolepis diminuta*. Three protozoa were also identified, *Giardia muris*, *Entamoeba muris* and *Isospora ratti* with infection rate of 25.45% (14/55). The flea Xenopsylla cheopis was the only ectoparasite identified from 4 rats (7.27%). Rat from all the three studied areas carried parasites with no significant difference in term of infection rates. Male rats showed significantly higher prevalence of parasites compared to female. Coinfection was observed in rats and some rats carried four types of parasites at one time. Findings of this study suggest that rats of Garmian region harbor zoonotic parasites which can pose risk to humans and animals. Therefore, actions have to be taken to content the potential of disease transmission.

Introduction

Rodents are the most abundant mammals in the world, they inhabit all the continents except the Antarctica and comprise more than one-third of all mammals on earth (Parshad, 1999). Black rat (*Rattus rattus)* sometimes called house rat or ship rat is a medium sized and long tailed rodent with dark grey color belong to the order rodentia. These small mammals have the ability to adapt to a wide variety of habitats such as wall cavities and false ceilings of buildings whereas in the wild, black rats live in cliffs, rocks, the ground, and trees (Franssen *et al*., 2016; Majeed, 2016). As a result of that and in addition to their omnivorous feeding nature, rats are known to carry viruses, bacteria and parasites (Singleton *et al*., 2003). Changing in ecosystems, establishing new urban areas and increasing human populations are directly related in the increase of rat transmitted diseases (Terraube, 2015). Rats represent a perfect reservoir host for veterinary importance parasites than can cause serious hazards to livestock and human (Sharma *et al*.,

2013). Endoparasites such as *Hymenolepis nana*, *H. diminuta*, *Capillaria sp*., *Trichuris muris*, Strongyles and coccidia are the most common and are transmitted mainly through the rat excrement (Pakdel *et al*., 2013 Meshkekar *et al*., 2014). In addition, rats can carry ectoparasites such as fleas, flies, ticks and lice which can also feed on other animal or human blood and therefore transmit various diseases (Soliman *et al*., 2001). Since rats are important vector of parasite transmission and because of their close habitat to human, it is crucial to explore rat parasites in various places of Iraq. Although, there are some epidemiological studies carried out on rat parasites in some areas of Iraq such as Missan, Baghdad and Kufa (Al-Ali and Jabbr, 2006; Karim and Al-Salihi, 2014; Majeed, 2016; Nayyef, 2017), little is known about parasite prevalence and rat zoonotic parasites in Garmian region. The present study aims to screen for intestinal parasites and ectoparasites in black rat (*Rattus rattus*) in three main districts of Garmian region (Kalar, Kifri and Khanaqin).

Materials and Methods

In this study 55 black rats (*Rattus rattus*) (21 male and 34 female) were trapped using cage trap baited with cheese, bread and date from center of three districts (Kifri, Kalar and Khanaqin) in Garmian region and the villages around from the period of December 2017 to February 2019 (Figure 1). The rats were trapped at night from different places such as old buildings, farms, garbage and drains. Trapped rat were immediately transferred to the research labs in Garmian University where humanly euthanized using absolute ether. Euthanized rats were searched for ectoparasites using brushes and fine toothed combs. After that, the rats were dissected, their intestines were placed in warm normal saline and longitudinally cut then the fecal contents were taken from different locations (Al-Bajalan, 2018). Fecal samples were examined for the existence of cysts, oocysts and helminthes ova using direct microscopy and standard salt floatation technique (Yokohata, 1989). The helminthes were preserved in 70% ethanol and stained using acetocarmine stain. Identification of the helminthes and protozoa was based on the morphological view of the adult worms, eggs, cysts and oocysts following (Soulsby, 1986; Molan and Faraj, 2016). Chi-square test was applied in the current study for analyzing differences in infection rates using PRISM software version 6.1. Differences between variables considered significant when P value was less than 0.05.

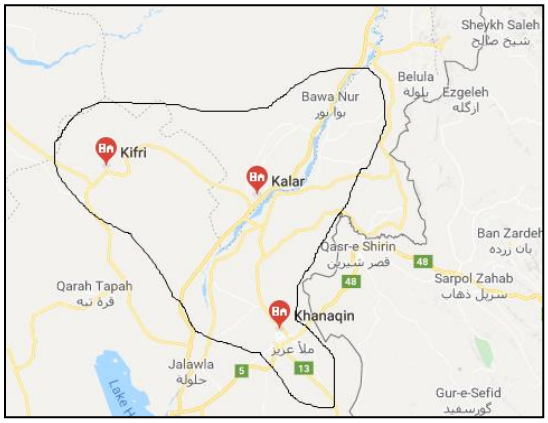

Figure 1: Sample collection areas, Kalar, Kifri and Khanaqin

Figure 2: A female black rat *Rattus rattus* trapped from Kalar district using cage trap

Results

Out of the 55 live trapped black rats, 24 were male and 31 female. The overall prevalence of parasites in rats was 61.81% (36/55) Table 2. Ten genera of parasites were identified in rats as follows: four nematodes; *Trichuris muris* (3.63%), *Capillaria sp*. (3.63%), *Strongyloides sp*. (14.55%) and *Trichostrongylus sp*. (1.81%). Two species of cestode were also identified; *Hymenolepis nana* (21.81%) and *H. diminuta* (32.72%). Three protozoa; *Isospora ratti* (12.72%), *Giardia muris* (5.45%) and *Entamoeba muris* (9.1%). One species of ectoparasite, the flea *Xenopsylla cheopis* was observed in four rats (7.27%), (Table 1). The highest rate of infected rats were trapped from

Kifri 70% (14/20) and the lowest rate was in Khanaqin 52.94% (9/17) and there was no significant differences between infection rates in the investigated areas P>0.05 (Table 2). Males were significantly more infected with parasites 83.33% (20/24) than that of female 41.93 (13/31) P<0.05 (Table 3). Some rats were infected with a single parasite while others were infected with more than one parasite and the highest parasite types identified in one rat was four.

Discussion

Rodents, particularly rats play an important role as reservoir host for zoonotic diseases. The present study aimed to screen for endo and ectoparasites in house rats (*Rattus rattus*). Out of the 55 examined house rats, 34 (61.81%) were infected with at least one parasitic type. *Trichuris muris* was observed in 3.63% of the rats. *Trichuris muris* has a direct life cycle and is a natural parasite of mice having the same biological and antigenic characteristics of Trichuris that infect livestock and humans (Antignano *et al*., 2011). There is no evidence this parasite could be zoonotic, though a study have shown that this parasite can transmit easily among different rodents (Smith and Carpenter, 2006). Pakdel *et al*. (2013) found that 14.49% of *Rattus norvegicus* and *Mus musculus* were infected with *T. muris* when they conducted their study in Iran. Lower rate of infection of black rats with *T. muris* (2.32%) was observed in India (Sharma *et al*., 2013). The presence of this parasite in various rodents indicates that the parasite is cosmopolitan. *Capillaria sp*. was also observed in the current study with a rate of infection (3.63%). Siti Shafiyyah (2012) reported six genera of parasites in wild rats in Kuala Lumpur-Malaysia and the rate of *Capillaria hepatica* was 13.9%. In Tehran-Iran, Meshkekar *et al*. (2014) reported that 1.7% of the studied black rats were infected with *Capillaria annulosa*. Rats were infected with different Strongyle nematodes with unidentified species (14.55%). Kia *et al*. (2001) reported in their study of the rodent parasites in Ahvaz-Iran that both *R. rattus* and *R. norvegicus* were infected with Strongylodes parasites. Cestodes showed the highest helminthes in the studied rats which were *H. diminuta* and *H. nana*. Similar studies have reported the presence of these cestodes in rodents in Iraq and some neighboring countries. Majeed (2016) reported that rats of the Iraqi capital, Baghdad collected from garbage areas carry various parasites including *H.nana* and *H.diminuta* which therefore have the potential to transmit zoonotic diseases to the nearby residence. Finding of this study agree with that of Nayyef (2017) who reported that 23.07 % of rats in Baghdad and outskirts were infected with *H.nana*. Cestodes do not only infect house and wild rats but can be found in laboratory rodents also. Karim and Al-Salihi (2014) reported that 75% of the laboratory rats in Kufa University were infected with *H.diminuta*. In Garmian region, there is no data on rat parasites prevalence. However, house mice which are possible to share territories with house rats were recently reported to carry *H.nana* (Al-Bajalan, 2018). The high rates of infected rats with cectodes which are zoonotic parasite pose a real threat to human.

Three protozoa were recovered from rats in this study; *Giardia muris*, *Entamoeba muris* and *Isospora ratti*. Protozoa have direct life cycle and are transmitted through food contaminated with feces. Most protozoa are host specific, though can be of zoonotic importance. There are some studies conducted on prevalence of rat protozoa in Iraq. In term of comparison, our findings showed lower prevalence of Giardia than that conducted in Baghdad by Majeed (2016) who found that 60.31% of rats were infected with Giardia. Nayyef (2017) reported that rats were infected with *Entamoeba histolytica* 7.69% and *Isospora sp*. 31.25 respectively. In Iran, Seifollahi *et al*. (2016) reported high infection of rats with *Giardia muris* 70% and *Entamoeba sp*. 36.4% when carried out a study on parasites of different types of rodents in southwestern Iran. In this study, rats from all the study areas harbored parasites, this indicates that rats are excellent reservoir for pathogens. However, some parasites were identified in rats of one area and not in the others. For example, the flea *Xenopsylla cheopis* were only recovered from rats of Kifri. On the other hand Trychostrongylus was only recovered from Kalar rats. This could be explained as rats occupy small territories therefore they preserve certain parasites within geographically close populations (Taylor, 1978). In our study male rats were significantly highly infected with

parasites than females. This is in agreement with the findings of Chaisiri *et al*. (2010) and Majeed (2016) who reported that male rats were significantly more infected with parasites than female in Thailand and Baghdad respectively. Morales-Montor *et al*. (2004) mentions that female mammals in general are more resistant to parasitic infections than male due to the gender-associated differences in exposure and immunosuppressive properties of testosterone. Single infection was observed more than co-infected rats in the present study. In Conclusion, Finding of this study reveals that house rats of Garmian region carry both endoparasites and ectoparasites. Some of these parasites are zoonotic and are of great health importance. Single rat can carry more than one pathogen at the same time, this increase the risk of disease transmission. Treatment or eradication of infected rats must be taken into consideration.

References

1.Al-Ali Z.A. and Jabbr A.K. (2006). Effect of some intestinal parasites on hematological parameters in domestic rodents. Journa of Misan Researches. 2 (4), 198-214.

2.Al-Bajalan M.M. (2018). Prevalence of intestinal cestode infections of conventionally maintained laboratory (albino) and house mice in Kalar district / Sulaymaniyah province. Journal of Garmian University. 6(1), 1-13.

3.Antignano F., Mullaly S.C., Burrows K. and Zaph C. (2011). *Trichuris muris* Infection: A Model of Type 2 Immunity and Inflammation in the Gut. Journal of Visualized Experiments. 11(2774), 1-5.

4.Chaisiri K., Chaeychomsri W., Siruntawineti J., Ribas A., Herbreteau V. and Morand S. (2010). Gastrointestinal Helminth Infections in Asian House Rats (*Rattus tanezumi*) from Northern and Northeastern Thailand. J. Trop. Med. Parasitol. 33, 29-35.

5.Franssen F., Swart A., van Knapen F. and van der Giessen J. (2016). Helminth parasites in black rats (*Rattus rattus*) and brown rats (Rattus norvegicus) from different environments in the Netherlands. Infection Ecology and Epidemiology. 6 (301413), 1-14.

6.Karim A.J and Al-Salihi K.A. (2014). Diagnostic Study on accidental *Hymenolepis diminuta* Infection in Laboratory Rats in Iraq. MRVSA. 3(3), 33-40.

7.Kia E.B., Homayouni M., Farahnak A., Mohebali M. and Shojai S. (2001). Study of Endoparasites of Rodents and their Zoonotic Importance in Ahwaz, South West Iran. Iran J Public Health.; 30(1-2), 49-52.

8.Majeed S.A. (2016). Prevalence of intestinal parasites in *Rattus rattus* in some districts in Baghdad/ Iraq. Al-Anbar J. Vet. Sci. 9 (1), 43-48.

9.Meshkekar M., Sadraei J., Mahmoodzadeh A. and Mobedi I. (2014). Helminth Infections in *Rattus ratus* and *Rattus norvigicus* in Tehran, Iran. Iranian J Parasitol. 9 (4), 548-552.

10.Molan A. and Faraj A.M (2016). Concise Medical Parasitology. 2nd edition. Iraq, P.128-200.

11.Morales-Montor J., Chavarria A., De Leon, M. A., Del Castillo L.I., Escobedo E,G., Sanchez E.N., Vargas J.A., Hernandez-Flores M., Romo-Gonzalez T. and Larralde C. (2004).Host Gender in Parasitic Infections of Mammals: An Evaluation of the Female Host Supremacy Paradigm. The Journal of Parasitology. 90 (3), 531-546.

12.Nayyef H.J. (2017). Occurrence of protozoal parasites in *Rattus rattus* rodent in Baghdad and outskirts, IRAQ. I.J.S.N. 8 (2), 386-389.

13.Pakdel N., Naem S., Rezaei F. and Chalechaleh A. (2013). Survey on helminthic infection in mice (*Mus musculus*) and rats (*Rattus norvegicus* and *Rattus rattus*) in Kermanshah, Iran. Veterinary Research Forum. 4 (2) 105 – 109.

14.Parshad VR. Rodent control in India. Integrative Pest Management Review.1999; 4: 97-126.

15.Seifollahi Z., Sarkari B., Motazedian M.H., Asgari Q., Ranjbar M.J. and Khabisi S.A. (2016). Protozoan Parasites of Rodents and Their Zoonotic Significance in Boyer-Ahmad District, Southwestern Iran. Veterinary Medicine International. 1-5.

16.Sharma D., Joshi S., Vatsya S. and Yadav C.L. (2013). Prevalence of gastrointestinal helminth infections in rodents of Tarai region of Uttarakhand. Parasit Dis. 37(2),181–184.

17.Singleton, G.R., Smythe, L., Smith, G., Spratt, D.M., alpin, K. and Smith, A.L. (2003). Rodent diseases in Southeast Asia and Australia:

inventory of recent surveys. In: Rats, Mice and people: rodent biology and management. ACIAR Monograph No 96. (Ed: G.R. Singleton, L.A. Hinds, C.J. Krebs and D.M. Sparrt) Canberra, Australian Center for international Agricultural Research; Pp.24-29.

18.Siti Shafiyyah C.O., Jamaiah I., Rohela M., Lau Y.L. and Siti Aminah F. Prevalence of intestinal and blood parasites among wild rats in Kuala Lumpur, Malaysia. Trop Biomed. 29(4), 544-50.

19.Smith K.F. and Carpenter S.M. (2006). Potential spread of introduced black rat (*Rattus rattus*) parasites to endemic deer mice (*Peromyscus maniculatus*) on the California Channel Islands. Diversity and Distributions, (Diversity Distrib.) 12, 742–748.

20.Soliman S, Marzouk AS, Main AJ, Montasser AA (2001) Effect of sex, size and age of commensal rat hosts on the infestation parameters of their ectoparasites in a rural area of Egypt. J Parasitol 87:1308–1316.

21.Soliman S., Marzouk A.S., Main A.J., Montasser A.A. (2001): Effect of sex, size and age of comensal rat hosts on the infestation parameters of their ectoparasites in a rural area of Egypt. J. Parasitol., 87, 1308-1316.

22.Soulsby, E. J. L. (1986). Helminths, Arthropodes and protozoa of domesticated Animals. 7 eds. Bailliere Tindal, London, U.K. pp: 99-166.

23.Taylor K.D. (1978). Range of Movement and Activity of Common Rats (*Rattus norvegicus*) on Agricultural Land. Journal of Applied Ecology. 15 (3), 663-677.

24.Terraube J. (2015) "Coping with fast climate change in northern ecosystems: mechanisms underlying the population-level response of a specialist avian predator." Ecography 38.7: 690-699.

25.Yokohata Y., Abe H., Ping Jiang Y. and Kamiya M. (1989). Gastrointestinal helminth fauna of japanese moles, *Mocera spp*. jpn. J. Vet. Res. 37, 1-13.

Table 1: Types of intestinal and ectoparsites in black rats (*Rattus rattus*) recovered in this study

Parasite type	Infection rate %	Parasite name	Infection rate %
Nematode	20 (11/55)	Trichuris muris	3.63
		Capillaria sp.	3.63
		Strongyloides sp.	14.55
		Trichostrongylus sp.	1.81
Cestode	43.63 (24/55)	Hymenolepis nana	21.81
		Hymenolepis diminuta	32.72
Protozoa	25.45 (14/55)	Isospora ratti	12.72
		Giardia muris	5.45
		Entamoeba muris	9.1
Ectoparasite	7.27 (4/55)	Xenopsylla cheopis	7.27
	Chi-square=20.56	D.F=3	P=0.0001

Table 2: Prevalence of intestinal parasites in black rats (*Rattus rattus*) according to sampling areas

Area	Samples examined	No. infected	Infection rate %
Kalar	18	11	61.11
Khanaqin	17	9	52.94
Kifri	20	14	70
Total	55	34	61.81
	Chi-square=1.139	D.F=2	P=0.5659

Table 3: Prevalence of intestinal parasites in male and female of *Rattus rattus* in Garmian region

Sex of rat	Samples examined	No. infected	Infection rate %
Male	24	20	83.33
Female	31	13	41.93
	Chi-square=4.342	D.F=1	P=0.0024

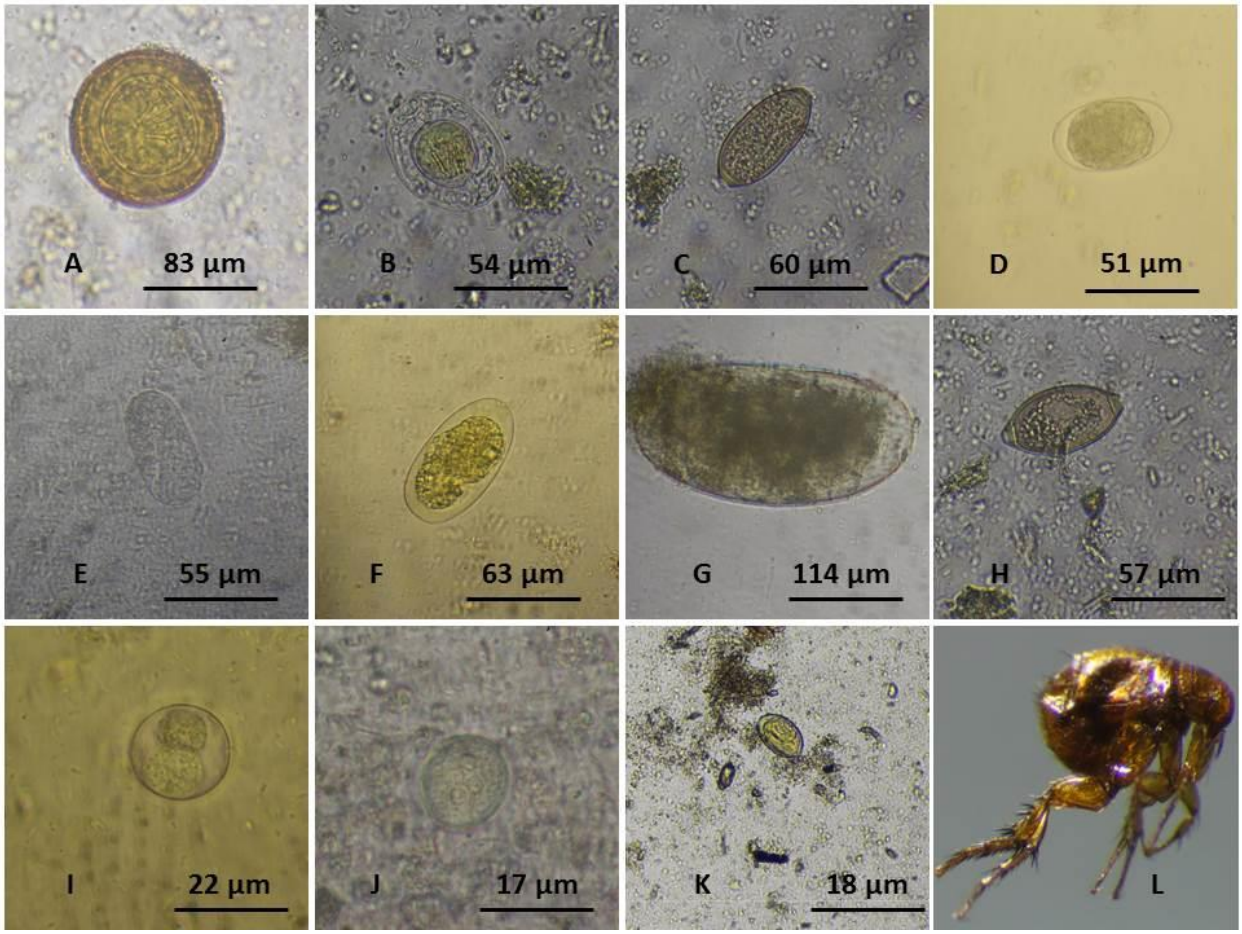

Figure 3: Ova and oocysts identified from intestinal content of black rat *Rattus rattus* from garmian region. A: Ova of *Hymenolepis diminuta* (40X), B: ova of *H. nana* (40X), C: ova of *Capillaria sp*. (40X), D,E,F: ova of *Strongyloides sp*. (40X), G: ova of *Trichostrongylus sp*. (40X), H: ova of *Trichuris muris* (40X), I: Oocyst of *Isospora ratti* (100X), J: Cyst of *Entamoeba muris* (100X), K: Cyst of *Giardia muris* (100X), L: Adult *Xenopsylla cheopis* (3.5X).