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A survey on the gastrointestinal parasites of exotic companion species in Tehran, Iran

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ABSTRACT

Exotic pet owners, ranging from small mammals to reptiles, comprise a considerable portion of veterinary clients. Parasitic infections are a threat both for the animal health and the health of the owner. This study aimed to investigate the gastrointestinal parasite species commonly encountered in exotic animal veterinary practice. Exotic pets' fecal samples were examined for fecal parasites macroscopically and microscopically by saline fecal smears, fecal floatation and specific staining. Chi-squared test to investigate the association between the presence and type of the parasites with host species and clinical symptoms ($p < 0.05$). Three hundred fecal samples, including 262 from small mammals, 37 from reptiles and 1 from primate were investigated for gastrointestinal endoparasites. The exotic pet species consisted of Lagomorpha (189/300; 63%), Rodentia (68/300; 22.66%), Reptilia (37/189; 12.33%), Eulipotyphla (4/300; 1.3%), a sugar glider and a marmoset. Thirty-nine samples were found to be infected with at least one gastrointestinal parasite (13%). Parasites observed in the feces of exotic pets included oocysts, strongyle-shaped eggs, oxyurid eggs (*Passalurus ambiguous*) and cestode eggs. A sample from a guinea pig was diagnosed to be infected with *Cryptosporidium sp*. There was no significant association between clinical symptoms and host species with parasite infection ($p > 0.05$). Considering the continuous species alteration, the unidentified sources of the pets in the market, and the potential of zoonotic infections periodical surveys on the common pet species and their parasitic infection are inevitable. Subclinical intestinal parasites in pet animals may alter the well-being of the companion animal if adjoined with poor management. Usually there is no need for anti-parasitic therapy in an animal without clinical signs, but regular diagnostic tests for parasites are advisable for effective veterinary practice.

Keywords

Companion animals, Helminths, Eimeria, Cryptosporidium, Exotic pet

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Abbreviations

sp.: species (singular)
spp.: species (plural)
P. ambiguous: Passalurus ambiguous
MZN: Modified Ziehl-Neelsen

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Introduction

Despite the slight differences in the comprehending exotic pet species worldwide, non-domestic species other than dogs and cats can generally be called exotic species [1]. Despite the proven benefits of pets for human well-being, it is impossible to ignore potential complications such as bites, allergies, and zoonotic diseases. [2]. In addition to the reported viruses, bacteria, and fungi of exotic animals, ectoparasites, and endoparasites, such as helminths and protozoa, can be hazardous to the animal's and the owner's health. [3, 4]. Parasites can be pathogenic, though some may be present without clinical sings. The close contact of companion animals with the owners, besides the inadequate health awareness and the health status of the owners, will alter the companion to the foe [5, 6]. A considerable percentage of referrals to veterinarians are owners of exotic species, which highlights the necessity of continuous education and surveys on the disorders and pathogens of these species. In addition, the diversity and ratio of common pet species and their pathogens vary with time. Exotic pet parasitic surveys revealed the presence of diverse helminth and protozoan parasites, though the results differ with the studied hosts and diagnostic methods. The present study attempts to identify the diversity and frequency of exotic pet intestinal parasites in Tehran.

Result

In the current study, 300 samples derived from two classes (Mammalia and Reptilia) and seven orders were studied for the presence of gastrointestinal parasites. The most abundant exotic pets belonged to mammalians (263/300: 87.7%), in which rabbits (*Oryctolagus*) (189/300; 63%), guinea pigs (*Cavia*) (33/300: 11%) and hamsters (*Mesocricetus*) (19/300: 6.3%) were the most abundant species, respectively. The investigated host species are summarized in Table 1.

In the current study, 13% (39/300) of the examined samples harbored parasites. Except for the 2 tortoise samples, the remaining infested samples were from mammalian species. Rabbits (27/189: 14.3%) were infected with oxyurid eggs (*Passalurus ambiguus)*, eimerian oocysts, and strongylid nematode eggs. One of the rabbits was concurrently infected with oocyst and strongylid eggs. Hamsters (6/19: 31.6%) were found to be infected with nematode, cestode eggs, and eimerian oocysts. One of them was simultaneously infected with cestode and nematode eggs. In the samples from the guinea pigs, apicomplexan protozoa, including Eimerian oocysts and oocysts of *Cryptosporidium sp.*, were detected (3/33: 9%). One of the samples from the investigated squirrels (1/16: 6.2%) contained *Eimeria* sp. oocysts. Other mammalian species, including a sugar glider, a marmoset, and four hedgehogs were not infected. The investigated Squamata were free of fecal parasites, though two of the 16 investigated Testudines (12.5%) harbored Eimerian oocysts. The most frequent parasite was Eimerian oocysts (70%), followed by strongylid eggs (17%), oxyurid eggs (7.3%) and rarely cestodes and *Cryptoporidium sp*. (2.4%) (Figure 1). The results are summarized in Table 1.

A hamster with simultaneous nematode and cestode infection and a rabbit with *oocysts* and nematodes were the hosts with multiparasitism.

It should be noted that most of the referral animals had routine checkups and/or veterinary health care and wellness information. 73% of the rabbits, 89% of the hamsters, 76% of the guinea pigs, 69% of the squirrels, 75% of the testudines, 71% of the lizards, and all of the investigated snakes, hedgehogs, the marmoset, and the sugar glider did not have any clinical symptoms and souk veterinary advice for routine and responsible pet care. Clinical symptoms such as anorexia and lethargy were observed in four cases of rabbits infected with oocysts. There was no significant association between clinical symptoms and parasite infection ($p > 0.05$).

Discussion

The present study included an investigation of gastrointestinal parasites in 300 exotic pets. The investigated hosts included 262 small mammals, 37 reptiles, and one primate. Thirteen percent (39/300) of the examined samples harbored parasites. Nematode eggs including oxyurids and strongylids, cestode eggs, *Eimeria* sp., and *Cryptosporidium* sp., were the detected parasites. Parasitologists worldwide have reported comparable parasitic species in their studies., though variations in the frequencies are evident due to different host species and diagnostic methodologies.

In the current study rabbits harbored oxyurid (*Passalurus ambiguus*), strongyle nematode eggs, and Eimerian oocysts. *Eimeria* oocysts, cestode egg, *Trichusis* sp., *Trichostrongylus*, and *P. ambiguous* had been reported in pet rabbits. A retrospective study on pet rabbits in Nigeria reported mange as the most frequent parasitosis. Helminthic infections and coccidiosis were in the next rows, respectively. The retrospective type of study in which the hospital database was used for data extraction and analysis may literally define the difference. In most studies on rabbits, oocyst infection has been the most commontype of gastrointestinal parasitic infection [8-12], however, the infection is mostly subclinical, causing little to no health

Table 1.
Frequency of host species and identified parasites in the fecal samples of pet exotic species.

Class	Order	Host	Number (%)	No. Infected (%)	Detected parasites
Mammalia	Lagomorpha	Rabbit (*Oryctolagus cuniculus*)	189 (63.0)	27 (14.3)	Oocysts, Strongylid eggs
	Rodentia	Guinea pig (*Cavia* sp.)	33 (11.0)	3 (9)	Oocysts, *Cryptosporidium* sp.
		Hamster (*Mesocricetus auratus*)	19 (6.3)	6 (31.6)	Oocysts, Strongylid eggs, Cestode eggs
		Squirrel (*Sciurus sp.*)	16 (5.3)	1 (6.2)	Oocysts
	Eulipotyphla	Hedgehog (*Erinaceus concolor*)	4 (1.3)	0	-
	Primates	Marmoset (*Callithrix* sp.)	1 (0.3)	0	-
	Diprotodontia	Sugar glider (*Petaurus breviceps*)	1 (0.3)	0	-
Total			263 (87.7)	37 (14.1)	-
Reptilia	Squamata	Snakes	13 (4.3)	0	-
		Iguana (*Iguana iguana*)	7 (2.3)	0	-
		Monitor lizard (*Varanus griseus*)	1 (0/3)	0	-
	Testudines	Tortoises (*Testudo* sp.)	16 (5.3)	2 (12.5)	Oocysts
Total			37 (12.3)	2 (5.4)	-
	Total		300 (100)		

complications. Hamsters are reported to be infected with nematode, cestode eggs, and Eimerian oocysts. In several studies, infection with the zoonotic cestode *Hymenolepis nana*, has been reported in pet rodents, and hamsters were infected more heavily than other pet rodent species [13-16]. In the present study guinea pigs were infected with oocysts and *Cryptosporidium* sp. In studies conducted on pet and household guinea pigs, protozoa, including oocysts, *Trichomonas*, and *Giardia*, helminthic infections, including *Paraspidodera* uncinate, and *Nippostrongylus*-like eggs have been reported [2, 17]. Guinea pig-adapted *Cryptosporidium* species have been assumed as a potential zoonotic agent [18, 19]. Investigated squirrels in the present study were mostly uninfected, and only an oocyst infection was identified. Various parasites, including *Dicrocoelium dendriticum, Syphacia* spp., *Nippostrongylus,* the *zoonotic Capillaria* sp., and different species of *Eimeia* have been reported from pet squirrels [20, 21]. Other exotic mammals investigated in the current study, such as sugar glider and hedgehog, were not infected (Table 1). However, there are reports of parasitosis in accidentally-killed hedgehogs harboring various species of parasites, including *Physaloptera* as a vector of the zoonotic *Leptospira* spp. and *Cryptosporidium* sp. [22-24]. Sugar gliders were reported to harbor parasites acquired from the wild or transmitted in captivity from various sources, including food or the immediate environment [25, 26]. Among all the examined reptile feces, only two turtles were found infected with nematodes, and no protozoan infection was observed (Table 1). *Entamoeba* sp., *Cryptosporidium* sp., *Isospora* sp., and *Eimeria* sp. and various helminths have been reported in reptiles [27, 28].

Current knowledge of exotic animal parasites is mostly based on cross-sectional surveys. Considering the continuous species alteration and the unidentified sources of the pets in the market, periodical surveys on the common pet species and their parasitic infection are inevitable. The wild-captured exotic animals may harbor various infectious organisms or they may have acquired the infection during translocation or in captivity in unsupervised conditions. It should be pointed out that inappropriate husbandry, mismanagement, and poor nutrition can suppress the immune system and lead to clinical symptoms [29]. The infected hosts in the present study and many similar studies worldwide were clinically asymptomatic [16, 20, 30]. The presence of prohibited species during the study signifies the boundless lucrative business of exotic animals and challenges the veterinarians for providing accurate husbandry and management advices [31-32].

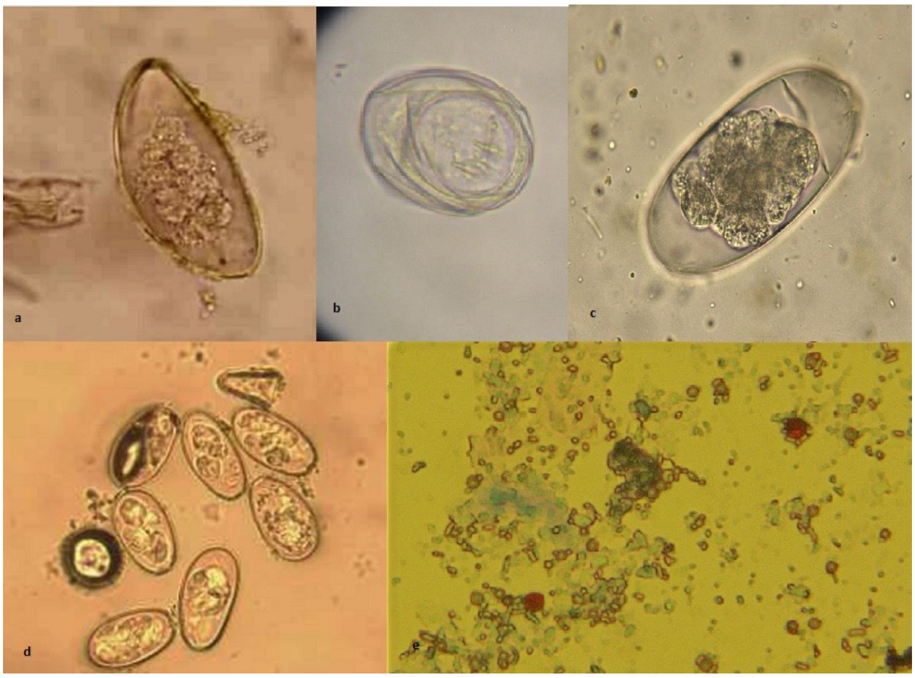

Figure 1.
a: Oxyurid eggs (*Passalurus ambiguus*) in rabbit feces. b: Cestode egg (note the 6-hooked oncosphere). c: Strongylid egg in rabbit feces (note the thin-shelled wall and the presence of the blastomeres. d: *Eimeria* sp. oocysts in rabbit feces. e: *Cryptosporidium* spp. oocysts in hamster feces (modified Ziehl-Neelsen stain, pink spherical organisms against the green background stain).

The well-being of the companion animal, in addition to the health of the client due to potential zoonotic pathogens should be considered [33-36]. Usually, there is no need for anti-parasitic therapy in an animal without clinical signs and infection. However, due to the close relationship of these animals with humans, especially with children and elderly owners, periodic parasitic monitoring tests are recommended.

Usually, exotic pet owners and breeders have insufficient information about the natural husbandry conditions. In sampling, it is essential to consider the intermittent excretion of parasites through defecation. In fact, with a single test, we may have false negative results. We recommend periodic sampling (three times at different intervals, depending on the type of parasite) to ensure the absence of Infections caused by parasitic diseases.. In this study, samples were collected and evaluated only once from each animal at the time of the hospital visit. Some studies using other diagnostic methods, such as post-mortem investigations (necropsy) or preparing slides directly from digestive tract cells, show different results. In the method applied in this study (flotation), saturated sodium chloride was used. One of the drawbacks of this solution is that it does not float heavy eggs such as *Trichuris* eggs. Also, to check the presence of amoeba and *Giardia*, it is adequate to mix the sediment sample with an iodine solution.

Materials and Methods

From July 2018 to March 2019, the fecal and dropping samples from referred exotic pets to the small animal Hospital of the Faculty of Veterinary Medicine, University of Tehran were collected. The samples were collected fresh in a single visit. For rodents, lagomorphs, and some reptiles, the process included pressing the rectal area or rubbing the cloacal area, for defecation stimulation. Occasionally, the samples were collected from the litter or the owners were provided with a container containing potassium dichromate 2.5% solution for sample collection.

Initially, the samples were investigated macroscopically with a stereomicroscope. A combination of direct wet smears, and smears after fecal flotation with saturated salt solution was performed on each sample [7]. Besides, modified Ziehl-Neelsen (MZN) staining was used for the detection of *Cryptosporidium* sp.

Statistical analysis using SPSS 16.0 (SPSS Inc., Chicago, Illinois, USA) for computation of descriptive statistics and Chi-squared test to investigate the association between the presence and type of the parasites with host species and clinical symptoms ($p < 0.05$) was used.

Authors' Contributions

A. R., S. N. and F. A. conceived and planned the experiments. M.N. carried out the experiments. F. S. took the lead in writing the manuscript. All authors provided critical feedback and helped shape the research, analysis and manuscript.

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Competing Interests

The authors declare that there is no conflict of interest.

Reference

1. Allison Goins M, Hanlon AJ. Exotic pets in Ireland: 1. Prevalence of ownership and access to veterinary services. I Vet J . 2021; 74:14. Doi.org/10.1186/s13620-021-00190-6.

2- Robertson I, Irwin P, Lymbery A, Thompson R. The role of companion animals in the emergence of parasitic zoonoses. Int J Parasitol. 2000; 30: 1369-1377. Doi.org/10.1016/S0020-7519(00)00134-X.

3- Rataj AV, Lindtner-Knific R, Vlahović K, Mavri U, Dovč A. Parasites in pet reptiles. Acta Vet Scand. 2011; 53: 33. 10.1186/1751-0147-53-33.

4- Lee ECY, Devlin JM. Knowledge of pet-related zoonotic diseases and pet care in Hong Kong, a heavily crowded urban setting. Vet Med Sci. 2022; 8: 130–138. Doi.org/10.1002/vms3.656.

5- Overgaauw PAM, Vinke Cm\M, Hagen MAEV, Lipman LJA. A one health perspective on the human–companion animal relationship with emphasis on zoonotic aspects. Int J Environ Res Public Health. 2020;17: 3789. Doi.org/10.3390/ijerph17113789.

6- Colella V, Wongnak P, Tsai YL, Nguyen VL, Tan DY, Tong KBY, Lu N, Fang F, Zhijuan Y, Wang J, Liu X, Dong J, Nurcahyo W, Hadi UK, Venturina V, Taweethavonsawat P, Tiwananthagorn S, Le TQ, Bui KL, Watanabe M, Rani PAMA, Traub RJ, Beugnet F, Chalvet-Monfray K, Halos L. Human social conditions predict the risk of exposure to zoonotic parasites in companion animals in East and Southeast Asia. Commun Med (Lond). 2022; 15:144. Doi: 10.1038/s43856-022-00210-8. PMID: 36380151.

7- Wolf D, Vrhovec MG, Failing K, Rossier C, Hermosilla C, Pantchev N. Diagnosis of gastrointestinal parasites in reptiles: comparison of two coprological methods. Acta Vet Scand 2014;12: 44. Doi: 10.1186/s13028-014-0044-4.

8- Mäkitaipale J, Karvinen I, Virtala AK, Näreaho A. Prevalence of intestinal parasites and risk factor analysis for Eimeria infections in Finnish pet rabbits. Vet Parasitol Reg Stud Reports. 2017; 9: 34-40. Doi: 10.1016/j.vprsr.2017.04.005.

9- Ilić T, Stepanović P, Nenadović K, Dimitrijević S. Improving agricultural production of domestic rabbits in Serbia by follow-up study of their parasitic infections. Iran J Vet Res. 2018;19: 290-297.

10- Ola-Fadunsin SD, Hussain K, Rabiu M, Ganiyu IA. Parasitic conditions of domestic owned rabbits in Osun State, southwestern Nigeria: Retrospective evaluation, risk factors and co-infestations. Int J Vet Sci Med. 2018; 6: 208-212. Doi.org/10.1016/j.ijvsm.2018.06.002.

11- Raue K, Heuer L, Böhm C, Wolken S, Epe C, Strube C. 10-year parasitological examination results (2003 to 2012) of faecal samples from horses, ruminants, pigs, dogs, cats, rabbits and hedgehogs. Parasitol Res. 2017;116: 3315-3330. Doi: 10.1007/s00436-017-5646-0.

12- Hajipour N, Zavarshani M. Ectoparasites and Endoparasites of New Zealand White Rabbits from North West of Iran. Iran J Parasitol. 2020;15: 266-271.

13- Panti-May JA, Caraveo-Centeno L, Hernández-Betancourt SF, Robles MDR, Machain-Williams C. Survey of intestinal helminths collected from pet rodents in México. Parasitol Res. 2017;116: 3239-3242. Doi: 10.1007/s00436-017-5626-4.

14- Sürsal N, Gökpinar S, Yildiz K. Prevalence of intestinal parasites in hamsters and rabbits in some pet shops of Turkey. Turkiye Parazitol Derg. 2014;38: 102-5. Doi: 10.5152/tpd.2014.3338.

15- Islam MM, Farag E, Hassan MM, Bansal D, Awaidy SA, Abubakar A, Al-Rumaihi H, Mkhize-Kwitshana Z. Helminth Parasites among Rodents in the Middle East Countries: A Systematic Review and Meta-Analysis. Animals (Basel). 2020;10: 2342. Doi: 10.3390/ani10122342.

16- Jarošová J, Antolová D, Šnábel V, Miklisová D, Cavallero S. The dwarf tapeworm *Hymenolepis nana* in pet rodents in Slovakia-epidemiological survey and genetic analysis. Parasitol Res. 2020;119: 519-527. Doi: 10.1007/s00436-019-06565-7.

17 - d'Ovidio D, Noviello E, Ianniello D, Cringoli G, Rinaldi L. Survey of endoparasites in pet guinea pigs in Italy. Parasitol Res. 2015;114: 1213-6. Doi: 10.1007/s00436-014-4289-7.

18- Borel N, Ciuria S, Flury T, Basso WU, Ruetten M. Zoonotic potential of guinea pigs: Outbreak of cryptosporidiosis combined with chlamydiosis in a breeding guinea pig herd. Schweiz Arch Tierheilkd. 2023;165: 59-63. English. Doi: 10.17236/sat00383.

19- Hernández-Castro C, Dashti A, Köster PC, Bailo B, López A, Llorente MT, González-Barrio D, Sánchez S, Carmena D. First report of rodent-adapted *Cryptosporidium* wrairi in an immunocompetent child, Spain. Parasitol Res. 2022;121: 3007-3011. Doi: 10.1007/s00436-022-07607-3.

20- d'Ovidio D, Rinaldi L, Ianniello D, Donnelly TM, Pepe P, Capasso M, Cringoli G. FLOTAC for diagnosis of endo-parasites in pet squirrels in southern Italy. Vet Parasitol. 2014; 24: 221-4. Doi: 10.1016/j.vetpar.2013.11.021.

21- Kvicerova J, Hofmannova L, Scognamiglio F, Santoro M. *Eimeria* sciurorum (Apicomplexa, Coccidia) from the Calabrian black squirrel (*Sciurus meridionalis*): an example of lower host specificity of eimerians. Fronti Vet Sci. 2020;7: 369. Doi:10.3389/fvets.2020.00369.

22- Youssefi MR, Rahimi MT, Halajian A, Moosapour AA, Nikzad R, Nikzad M, Ramezanpour S, Ebrahimpour S. Helminth Parasites of Eastern European Hedgehog (*Erinaceus concolor*) in Northern Iran. Iran J Parasitol. 2013; 8: 645-50.

23- Cirak VY, Senlik B, Aydogdu A, Selver M, Akyol V. Helminth parasites found in hedgehogs (Erinaceus concolor) from Turkey. Prev Vet Med. 2010;97: 64-6. Doi: 10.1016/j.prevetmed.2010.07.007.

24- Mariacher A, Santini A, Del Lesto I, Tonon S, Cardini E, Barone A, Eleni C, Fichi G, Perrucci S. Endoparasite Infections of the European Hedgehog (*Erinaceus europaeus*) in Central Italy. Animals (Basel). 2021;11: 3171. Doi: 10.3390/ani11113171.

25- Gallego Agúndez M, Villaluenga Rodríguez JE, Juan-Sallés C, Spratt DM. First report of parasitism by *Ophidascaris robertsi* (Nematoda) in a sugar glider (*Petaurus breviceps*, Marsupialia). J Zoo Wildl Med. 2014; 45: 984-6. Doi: 10.1638/2014-0107.1.

26- Bogan JrJE, Garner MM, Childress A, Wellehan JFX. Larval Neodiplostomum americanum in the lung of a sugar glider (Petaurus breviceps). J Exot Pet Med. 2019;30: 72-75. Doi.org/10.1053/j.jepm.2018.12.003.

27-Youssefi MR, Mousapour A, Nikzad R, Gonzalez-Solis D, Halajian A, Rahimi MT. Gastrointestinal helminths of the Caspian turtle, *Mauremys caspica* (Testudines), from Northern Iran. J Parasit Dis. 2016; 40: 65-68. Doi: 10.1007/s12639-014-0446-2.

28- Arabkhazaeli F, Rostami A, Gilvari A, Nabian S, Madani SA. Frequently observed parasites in pet reptiles' feces in Tehran. Iran J Vet Med. 2018;12: 19-25. Doi.org/10.22059/IJVM.2018.233466.1004812.

29- Lewis M, Bartley PM, Katzer F, Morrison LR, Philbey AW, Eatwell K, Walker D. Conjunctival *Cryptosporidium avium* infection in a captive inland bearded dragon (*Pogona vitticeps*). J Exot Pet Med. 2020; 35: 23-26. Doi.org/10.1053/j.jepm.2020.05.014.

30- Mendoza-Roldan JA, Modry D, Otranto D. Zoonotic Parasites of Reptiles: A Crawling Threat. Trends Parasitol. 2020;36 :677-687. Doi: 10.1016/j.pt.2020.04.014.

31- Pérez JM. Parasites, pests, and pets in a global world: new perspectives and challenges. J Exot Pet Med. 2009;18: 248-253. Doi: 10.1053/j.jepm.2009.09.003.

32- Chen J, Wang W, Lin Y, Sun L, Li N, Guo Y, Kvac M, Ryan U, Feng Y, Xiao L. Genetic characterizations of *Cryptosporidium* spp. from pet rodents indicate high zoonotic potential of pathogens from chinchillas. One Health. 2021;13: 100269. Doi: 10.1016/j.onehlt.2021.100269.

33- Lockwood JL, Welbourne DJ, Romagosa CM, Cassey P, Mandrak NE, Strecker A, Leung B, Stringham OC, Udell B, Episcopio-Sturgeon DJ, Tlusty MF, Sinclair J, Springborn MR, Pienaar EF, Rhyne AL, Kellerv R. When pets become pests: the role of the exotic pet trade in producing invasive vertebrate animals. Front Ecol Environ. 2019;17: 323-330. Doi.org/10.1002/fee.2059.

34- Chomel, BB, Belotto A, Meslin FX. Wildlife, exotic pets, and emerging zoonoses. Emerg Infect dis 2007; 13: 6-11. Doi.org/10.3201/eid1301.060480.

35- Cormier LA, Jolly PE. The primate zoonoses: culture change and emerging diseases. 1st ed. London: Routledge; 2018.

36- Takaki Y, Takami Y, Watanabe T, Nakaya T, Murakoshi F. Molecular identification of *Cryptosporidium* isolates from ill exotic pet animals in Japan including a new subtype in *Cryptosporidium fayeri*. Vet Parasitol Reg Stud Reports. 2020; 21: 100430. Doi: 10.1016/j.vprsr.2020.100430.

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