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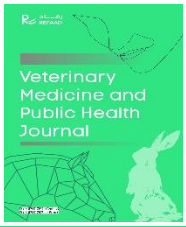

Anthropophilic Small Mammals: Potential Source of Zoonotic Enteric Parasites in the Commune of Abobo, District of Abidjan (Côte d'Ivoire)

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Abstract

Objectives: This study aims to identify and assess intestinal parasites with zoonotic potential in terrestrial small mammals to better understand the associated risks.

Methods: Live captures were performed using Sherman traps placed in human dwellings within the Abobo commune of Abidjan. Captured animals were euthanized and their legs were thoroughly washed with a Sodium Acetate Acetic Acid Formol solution. Subsequently, the digestive tract contents and leg washing fluids were examined using the Ritchie concentration method.

Results: *Mus musculus* (75.3%) and *Rattus rattus* (13.5%) emerged as the most prevalent of small mammal species. Overall, 33.3% of these animals were infected with intestinal parasites. The predominant helminth species were *Hymenolepis diminuta* (8.9%) and *Ancylostoma* sp. (6.9%), while the primary pathogenic protozoa detected was *Giardia intestinalis* (2.3%).

Conclusion: The presence of parasites of public health importance proves that cohabitation of small mammals with humans poses a significant risk to both public and veterinary health. These data therefore provide valuable information to local and provincial administrations, which should consider population control measures for small mammals to mitigate the transmission of zoonotic diseases to humans. They also provide information to medical practitioners for the diagnosis of possible zoonoses, and a reference for further studies in urban environments in Côte d'Ivoire.

Keywords: *Abidjan; anthropophilic; small mammals; intestinal parasites; zoonotic.*

1 Introduction

Urbanization has played a crucial role throughout human history, as cities offer numerous advantages that enhance labor productivity and overall quality of life (Shadrina *et al.*, 2021) However, when urbanization occurs without proper control, it surpasses the capacity of national and local governments to provide essential services (Houemenou, Kassa & Libois, 2014)This uncontrolled urban development is prevalent in many African countries, lacking coherent policies that consider biodiversity conservation or rational land-use planning (Houemenou *et al.*, 2014; Akpatou *et al.*, 2018). Consequently, it leads to chaotic spatial utilization and the proliferation of liquid and solid waste (N'Guessan & Alla, 2019).The accumulation of waste provides favorable conditions for the proliferation of various animal species. Natural habitats face fragmentation and degradation due to expanding urban development (Liu *et al.*, 2017) Consequently, less resilient species vanish, being replaced by ecologically flexible species that have adapted well to urban life, including anthropophilic terrestrial small mammals (Santini *et al.*, 2019). Urban biocenoses of small mammals are largely dominated by these species thanks to their strong demographic dynamics, adaptability, and opportunistic feeding habits (Fortin, 2012), particularly among rodents and commensal soricomorphs (Shiels *et al.*, 2014).

Abidjan, like many major African cities, conforms to this pattern. The communes in the District of Abidjan offer various habitats conducive to highly diverse rodent and soricomorph communities (Dongo *et al.*, 2009), leading to a permanent and effective human-rodent-soricomorph cohabitation (Akpatou *et al.*, 2018). This cohabitation, however, is not without its dangers for humans, as it poses numerous nuisances and real risks of zoonosis (Richardson *et al.*, 2017). According to the World Health Organization (WHO), rodents have long been a threat to public health, symbolizing poverty, underdevelopment, and epidemics (WHO, 2019). They can host numerous protozoan and helminth endoparasites (Tijjani *et al.*, 2020; Badparva *et al.*, 2023) acting as reservoir hosts for over 60 infectious diseases transmitted to humans (Dahmana *et al.*, 2020), Despite reports on the parasites of anthropophilic small mammals from other regions, documented studies in Côte d'Ivoire are scarce. This study contributes valuable data on the biodiversity of intestinal parasites in small mammals captured within human habitats in the commune of Abobo, District of Abidjan.

2 Material and methods

2.1 Study area

The study was conducted in the District of Abidjan (5°10, 5°30 N; 3°45, 4°21 W), with a specific focus on the commune of Abobo (5° 20' 56'N; 4° 00' 42') (Figure 1). The climate in Abobo mirrors that of the entire district, characterized by a transitional equatorial climate with four distinct seasons, comprising two rainy seasons and two dry seasons. (N'Guessan Bi *et al.*, 2021). The long rainy season spans from April to July, followed by the short dry season from July to September, the short rainy season from September to November, and finally, the long dry season from December to March. Monthly average temperatures fluctuate between 24.2°C in August and 27.4°C in March, while average monthly relative humidity varies from 78% in January to 87% in September (Kablan, 2016) . Rainfall patterns also display significant variability, with average monthly precipitation ranging from 23 mm in January to 525 mm in June (Kouassi *et al.*, 2020).

Over time, the population in Abobo has experienced rapid growth, increasing from 134,000 in 1975 to 1,030,658 in 2014, making up 23.4% of Abidjan's total demographic weight (INS-RGPH, 2014). As the second most densely populated commune in the district of Abidjan, this high demographic pressure has led to the construction of housing units that often deviate from urban norms. Consequently, most neighborhoods in the municipality lack basic services, except for the Habitat-Sogefiha neighborhood, and are bereft of essential infrastructure, such as roads and sanitation facilities (ONU-Habitat, 2012). More than 70% of the municipality's area is occupied by under-equipped neighborhoods, and approximately 66% of the housing consists of courtyard housing (Diby, 2009). These under-equipped neighborhoods, housing around 60% of the commune's population, suffer from the absence of fundamental infrastructure. Furthermore, Abobo lacks significant commercial or industrial centers, resulting in the informal sector being the dominant source of employment, comprising activities such as trade, transport, and handicrafts (ONU-Habitat, 2012) The informal sector plays a vital role in the municipality's economy, generating over 75% of employment opportunities, with trade being the most prevalent activity, accounting for 85% of businesses (Diby, 2018).

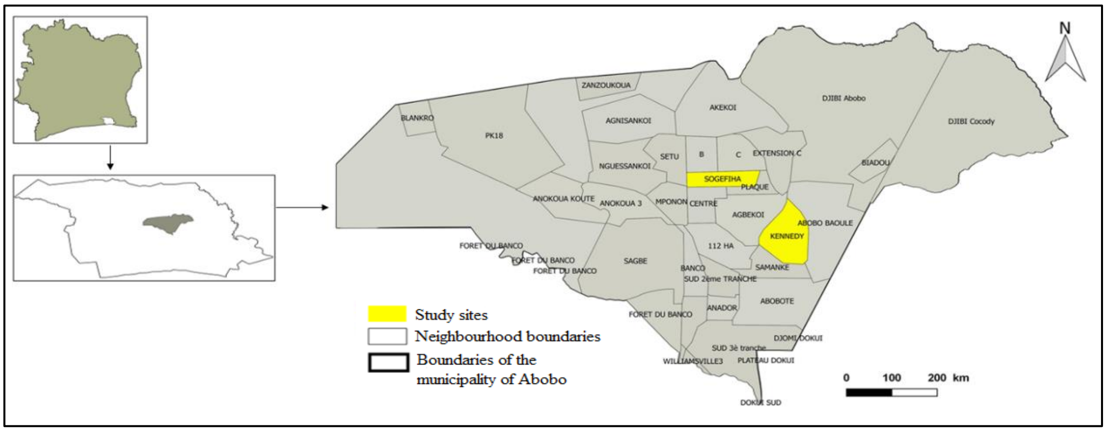

Fig. 1. Study area

Ethical considerations:

Ethical approval for this study was granted by the "Comité National d'Ethique des Sciences de la Vie et de la Santé" (CNESVS) of Côte d'Ivoire, reference N°: 179-18/MSHP/CNESVS-kp This authorisation gave access to participants' homes to capture the various animals concerned and to handle and sacrifice them for biological examination.

Capture and identification of small mammals:

Sherman-type traps measuring 7.5 x 9 x 23 cm were used to capture small mammals These traps were baited with a combination of peanut paste and dried fish. In each selected house, four Sherman-type traps were set, and the traps were checked every morning from 7.30 a.m. to 10.00 a.m. Baits were refreshed during trap inspections, typically every two days as needed (Bohoussou, 2014). Each captured animal was placed in separate Zip lock bags, and humanely euthanised with ether. Subsequently, the specimens were transported to the "Laboratoire des Milieux Naturels et Conservation de la Nature" at the UFR Biosciences of the Université Félix Houphouët-Boigny, for further laboratory work (Akpatou *et al.*, 2018).

In the laboratory, each specimen underwent various assessments. Weight measurements were taken using Pesola precision spring balances with an accuracy of +/- 0.3%. External morphological characteristics, such as body length, tail length, hind foot length, and ear length, were measured following which, age and sex were determined. Identification of the small mammals was performed directly based on their morphological characteristics, aided by references from mammal identification guides (Happold, 2013; Happold & Happold, 2013).

Isolation and examination of parasites:

Following identification, the legs of each small mammal specimen were thoroughly washed using a Sodium Acetate Acetic Acid Formol (SAF) solution, employing a brush for effective cleaning. The wash solution was carefully collected in an SAF tube and preserved for subsequent parasitological analysis. Subsequently, the animal was dissected, and the contents of the digestive tract were collected and stored in another tube containing SAF liquid, also intended for parasitological analysis.

The parasitological examination of the collected samples was conducted using the ether concentration method, commonly known as the Ritchie method. To execute this method, the leg wash fluid and the digestive tract content fluid were separately transferred into glass conical test tubes and subjected to centrifugation at 3000 rpm for 3 minutes. Following centrifugation, the sediments were meticulously examined under a light microscope, employing 10X magnification for general parasite examination and 40X magnification for specific identification of various cysts and ova of parasites.

2.2 Statistical analysis

For statistical analysis, we used STATA version 14.2 software by Stata Corporation in College Station, TX, USA. Fischer's exact test was employed to compare infection rates, while confidence intervals were applied to assess variations in different prevalences and relative abundances.

3 Results

3.1 Small mammal inventory

In this study, a total of 303 specimens of anthropophilic terrestrial small mammals were collected, comprising 285 rodents (94.1%) and 18 soricomorphs (5.9%). Among the rodents, *Mus musculus* (n= 228), *Rattus rattus* (n=41), *Rattus norvegicus* (n=15), and *Mastomys* sp. (n=1) were identified. The insectivores consisted of *Crocidura olivieri* (n= 17) and *Crocidura poensis* (n=1) (Table 1).

Table 1: Inventory of small mammal species caught in the Abobo commune, October-November 2019 and March 2020

Order	Family	Genus	species	Abundance (N=303)	
				n	Ra (%)
Rodents	Murinae	*Mus*	*Mus musculus*	228	75.2
		Rattus	*Rattus rattus*	41	13.5
			Rattus norvegicus	15	5.0
		Mastomys	*Mastomys sp*	1	0.3
Scorimorphs	Soricidae	*Crocidura*	*Crocidura olivieri*	17	5.6
			Crocidura poensis	1	0.3

n = number of individuals per species; N = total number of all species; Ra = relative abundance

3.2 Parasitic infestations in small mammals

Out of the 303 small mammals examined, 101 were found to be infected with one or more intestinal parasites, resulting in an overall prevalence of 33.3%. The infection rates for specific small mammal species were as follows: *Mus musculus* (27.6%), *Rattus rattus* (51.2%), *Crocidura olivieri* (47.1%), and Rattus norvegicus (53.3%). Notably, the single captured specimen of *Crocidura poensis* was parasitized, yielding a prevalence of 100%. On the other hand, the sole *Mastomys* sp. specimen caught did not carry any parasites (Table 2). Statistically significant differences in prevalence rates were observed among the various small mammal species (Fisher's exact test, $p < 0.001$).

A total of fifteen (15) species of intestinal parasites were identified in small mammals in the commune of Abobo, including nine (09) helminth species and six (06) protozoan species. The prevalence of helminth infections was 22.1% (95% CI: 17.6-27.2%), while that of protozoan infections was 16.8% (95% CI: 12.8-21.5%). There was no significant difference in prevalence between these two groups of parasites, as small mammals were found to be infected by both helminths and protozoa indiscriminately.

Among the helminth species, *Hymenolepis diminuta* exhibited the highest prevalence at 8.91% (95% CI: 5.95-12.70%), followed by *Ancylostoma* sp. at 6.9% (95% CI: 4.3-10.4%). The other identified helminth species and their respective prevalences were as follows: *Trichuris trichiura* (1.9%, 95% CI: 0.7-4.3%), *Enterobius vermicularis* (1.9%, 95% CI: 0.7-4.3%), *Capillaria hepatica* (1.6%, 95% CI: 0.5-3.8%), *Hymenolepis nana* (1.3%, 95% CI: 0.4-3.4%), *Ascaris lumbricoides* (1.0%, 95% CI: 0.2-2.9%), Fasciola sp. (0.7%, 95% CI: 0.1-2.4%), and *Capillaria* sp. (0.3%, 95% CI: 0.0-1.8%).

Regarding protozoan species, the prevalence rates were as follows: *Entamoeba coli* (11.9%, 95% CI: 8.5-16.1%), *Endolimax nana* (2.3%, 95% CI: 0.9-4.7%), *Giardia intestinalis* (2.3%, 95% CI: 0.9-4.7%), *Chilomastix mesnili* (1.6%, 95% CI: 0.5-3.8%), *Blastocystis hominis* (0.3%, 95% CI: 0.0-1.8%), and *Coccidia* sp. (0.3%, 95% CI: 0.0-1.8%). *Hymenolepis diminuta* was the most prevalent helminth species, while *Entamoeba coli* was the most frequent protozoan species, with a prevalence of 8.9% and 11.9%, respectively. Notably, no significant difference in prevalences was observed among these parasite species based on the species of small mammal (Table 2).

Table 2: Prevalence of intestinal parasites in anthropophilic small mammals captured in the Commune of Abobo, October-November 2019 and March 2020.

Small mammals	*M. musculus* (N= 228)		*R rattus* (N= 41)		*R norvegicus* (N= 15)		*C olivieri* (N= 17)		*C poensis* (N= 1)		*Mastomys* sp (N= 1)		**Total (N= 303)**	
Parasites	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)	n	% (95% CI)
Helminths*	**41**	**17.9 (13.2-23.6)**	**13**	**31.7 (18.1-48.1)**	**7**	**46.7 (21.3-73.4)**	**6**	**35.3 (14.2-61.7)**	**0**	**0.0 (0.0-9.8)**	**0**	**0.0 (0.0-9.8)**	**67**	**22.1 (17.6-27.2)**
Ascaris lumbricoïdes	2	0.9(0.1-3.1)	1	2.4 (0.1-12.8)	0	0.0 (0.0-21.8)	0	0.0 (0.0-19.5)	0	0.0 (0.0-9.8)	0	0.0 (0.0-9.8)	3	0.9 (0.2-2.9)
Trichuris trichiura	14	6.1 (3.4-10.1)	3	7.3 (1.5-19.9)	4	26.7 (7.8-55.1)	0	0.0 (0.0-19.5)	0	0.0 (0.0-9.8)	0	0.0 (0.0-9.8)	21	6.9 (4.3-10.4)
Ancylostoma sp	2	0.9 (0.1-3.1)	2	4.9 (0.6-16.5)	0	0.0 (0.0-21.8)	2	11.7 (1.5-36.4)	0	0.0 (0.0-9.8)	0	0.0 (0.0-9.8)	6	1.9 (0.7-4.3)
Fasciola sp	1	0.4 (0.0-2.4)	1	2.4 (0.1-12.8)	0	0.0 (0.0-21.8)	0	0.0 (0.0-19.5)	0	0.0 (0.0-9.8)	0	0.0 (0.0-9.8)	2	0.7 (0.1-2.3)
Enterobius vermiculais	5	2.2 (0.7-5.0)	1	2.4 (0.1-12.8)	0	0.0 (0.0-21.8)	0	0.0 (0.0-19.5)	0	0.0 (0.0-9.8)	0	0.0 (0.0-9.8)	6	1.9 (0.7-4.3)
Hymenolepis dimiuta	19	8.3 (5.1-12.7)	5	12.2 (4.1-26.2)	2	13.3 (1.6-40.5)	1	5.9 (0.1-28.7)	0	0.0 (0.0-9.8)	0	0.0 (0.0-9.8)	27	8.9 (5.6-12.7)
Hymenolepis nana	1	0.4 (0.0-2.4)	1	2.4 (0.1-12.8)	0	0.0 (0.0-21.8)	2	11.7 (1.5-36.4)	0	0.0 (0.0-9.8)	0	0.0 (0.0-9.8)	4	1.3 (0.4-3.4)
Ccappillaria hepatica	2	0.9 (0.1-3.1)	1	2.4 (0.1-12.8)	0	0.0 (0.0-21.8)	2	11.7 (1,5-36,4)	0	0.0 (0.0-9.8)	0	0.0 (0.0-9.8)	5	1.7 (0.5-3.8)
Capillaria sp	0	0.0% (0.0-1.6)	0	0.0% (0.0-8.6)	1	6.7 (0.2-31.9)	0	0.0 (0.0-19.5)	0	0.0 (0.0-9.8)	0	0.0 (0.0-9.8)	1	0.3 (0.0-1.8)
Protozoa**	**33**	**14.5 (10.2-19.7)**	**11**	**26.8 (14.2-42.9)**	**3**	**20.0 (4.3-48.1)**	**3**	**17.6 (3.8-43.4)**	**1**	**100 (2.5-100)**	**0**	**0.0 (0.0-9.8)**	**51**	**16.8 (12.8-21.5)**
Entamoeba coli	21	9.2 (5.8-13.7)	9	21.9 (10.6-37.6)	3	20.0 (4.3-48.1)	2	11.7 (1.5-36.4)	1	100 (2.5-100)	0	0.0 (0.0-9.8)	36	11.9 (8.5-16.1)
Endolimax nana	5	2.2 (0.7-5.0)	0	0.0 (0.0-8.6)	1	6.7 (0.2-31.9)	0	0.0 (0.0-19.5)	1	100 (2.5-100)	0	0.0 (0.0-9.8)	7	2.3 (0.9-4.7)
Giardia intestinalis	5	2.2 (0.7-5.0)	1	2.4 (0.1-12.8)	0	0.0 (0.0-21.8)	1	5.9 (0.1-28.7)	0	0.0 (0.0-9.8)	0	0.0 (0.0-9.8)	7	2.3 (0.9-4.7)
Chilomastix. mesnilii	2	0.9 (0.1-3.1)	2	4.9 (0.6-16.5)	1	6.7 (0.2-31.9)	0	0.0 (0.0-19.5)	0	0.0 (0.0-9.8)	0	0.0 (0.0-9.8)	5	1.7(0.5-3.8)
Blastocytis hominis	1	0.4 (0.0-2.4)	0	0.0 (0.0-8.6)	0	0.0 (0.0-21.8)	0	0.0 (0.0-19.5)	0	0.0 (0.0-9.8)	0	0.0 (0.0-9.8)	1	0.3 (0.0-1.8)
Coccidia spp	0	0.0 (0.0-1.6)	1	2.4 (0.1-12.8)	0	0.0 (0.0-21.8)	0	0.0 (0.0-19.5)	0	0.0 (0.0-9.8)	0	0.0 (0.0-9.8)	1	0.3 (0.0-1.8)
Total***	**63**	**27.6 (21.9-33.9)**	**21**	**51,2 (35.1-67.1)**	**8**	**53.3 (26.6-78.7)**	**8**	**47.1 (22.9-72.2)**	**1**	**100 (2.5-100)**	**0**	**0.0 (0.0-9.8)**	**101**	33.3 (28.0-38.9)

*: proportion of small mammals infected by at least one helminth; n: number of infected individuals
**: proportion of small mammals infected with at least one protozoan
***: proportion of small mammals infected by at least one intestinal parasite
(%): prevalence

3.3 Prevalence of parasitic infestations by age and sex

Out of the 303 small mammals examined, 146 were males and 157 were females. The prevalence of parasitic infestation in males was 31.5% (95% CI: 24.1-39.7%), while in females, it was 35.0% (95% CI: 27.6-43.0%). However, no significant difference was observed between these prevalence rates based on sex (Table 3). Furthermore, when considering each individual parasite species, there were no significant differences in prevalence according to sex (Table 3). Both males and females were equally exposed to parasites in the study.

Regarding the age of the small mammals, the prevalence of infection among adults was 35.6% (95% CI: 29.7-41.9%), compared to 21.1% (95% CI: 9.6-37.3%) in juveniles and 26.7% (95% CI: 7.8-55.1%) in subadults. Surprisingly, there was no significant difference in the prevalence of infection among the different age groups.

Table 3: Prevalences of intestinal parasites in anthropophilic small mammals captured in Abobo commune according to sex, October-November 2019 and March 2020.

	Female (N = 157)		Male (N = 146)		Total (N = 303)	
Parasites	**n**	**% (95% CI)**	**n**	**% (95% CI)**	**n**	**% (95% CI)**
Helminths						
Ascaris lumbricoides	3	1.9 (0,4-5.5)	0	0.0 (0.0-2.5)	3	1.0 (0.2-2.9)
Ancylostoma sp	12	7.6 (4.0-12.9)	9	6.2 (2.9-11.4)	21	6.9 (4.3-10.4)
Trichuris trichiura	4	2.6 (0.7-6.4)	2	1.4 (0.2-4.9)	6	1.9 (0.7-4.3)
fasciola sp	2	1.3 (0.2-4.5)	0	0.0 (0.0-2.5)	2	0.7 (0.1-2.4)
Enterobius vermiculais	4	2.6 (0.7-6.4)	2	1.4 (0.2-4.9)	6	1.9 (0.7-4.4)
Hymenolepis diminuta	15	9.6 (5.5-15.3)	12	8.2 (4.3-13.9)	27	8.9 (5.9-12.7)
Hymenolepis nana	2	1.3 (0.2-4.5)	2	1.4 (0.2-4.9)	4	1.3 (0.4-3.4)
Capillaria hepatica	2	1.3 (0.2-4.5)	3	2.1 (0.4-5.9)	5	1.7 (0.5-3.8)
Capillaria sp	1	0.6 (0.0-3.5)	0	0.0 (0.0-2.5)	1	0.3 (0.0-1.8)
Protozoa						
Entamoeba coli	21	13.4 (8.5-19.7)	15	10.3 (5.9-16.4)	36	11.9 (8.5-16.1)
Endolimax nana	4	2.6 (0.7-6.4)	3	2.1 (0.4-5.9)	7	2.3 (0.9-4.7)
Giardia intestinalis	2	1.3 (0.2-4.5)	5	3.4 (1.1-7.8)	7	2.3 (0.9-4.7)
Chilomastix mesnilii	2	1.3 (0.2-4.5)	3	2.1 (0.4-5.9)	5	1.7 (0.5-3.8)
Blastocystis hominis	1	0.6 (0.0-3.5)	0	0.0 (0.0-2.5)	1	0.3 (0.0-1.8)
Coccidia spp.	0	0.0 (0.0-2.3)	1	0.7 (0.0-3.8)	1	0.3 (0.0-1.8)
Total	**55**	**35.0 (27.6-43.0)**	**46**	**31.5 (24.1-39.7)**	**101**	**33.3 (28.0-38.9)**

N: number of individuals examined; n: number of infected individuals; (%): prevalence

3.4 Distribution of parasites in the digestive tract and on the legs

Table 4 presents the distribution of parasites in the digestive tract and on the legs of anthropophilic small mammals. Among the observed parasites, seven species were found in both the digestive tract and on the legs, including *Ascaris lumbricoides, Ancylostoma* sp, *Trichuris trichiura, Enterobius vermicularis, Hymenolepis diminuta, Hymenolepis nana,* and *Capillaria hepatica*. However, *Fasciola* spp was exclusively observed in the digestive tract, while *Capillaria* spp was only found on the legs. Notably, while helminths were present in both locations, protozoa were not observed on the legs. All six protozoan species were found in the digestive tract only.

Overall, the parasites were significantly more prevalent in the digestive tract (28.4%, 95% CI: 23.4-33.8%) compared to the legs (8.3%, 95% CI: 5.4-11.9%). Among the different parasite species, only *Hymenolepis diminuta* and *Entamoeba coli* exhibited a significant difference in prevalence between the digestive tract and the legs.

Table 4: Distribution of intestinal parasites in the digestive tract and on the legs

	Digestive tract (N = 303)		Legs (N = 303)	
Parasites	**n**	**% (95% CI)**	**n**	**% (95% CI)**
Helminths				
Ascaris lumbricoïdes	2	0.7 (0.1-2.4)	2	0.7 (0.1-2.4)
Ancylostoma sp	16	5.3 (3.0-8.4)	5	1.6 (0.5-3.8)
Trichuris trichiura	4	1.3 (0.4-3.3)	2	0.7 (0.1-2.4)
fasciola sp	2	0.7 (0.1-2.4)	0	0.0 (0.0-1.2)
Enterobius vermiculais	1	0.3 (0.0-1.8)	6	1,9 (0.7-4.3)
Hymenolepis diminuta	21	6.9 (4.3-10.4)	5	1,6 (0.5-3.8)
Hymenolepis nana	2	0.7 (0.1-2.4)	2	0.7 (0.1-2.4)
Capillaria hepatica	5	1.6 (0.5-3.8)	1	0.3 (0.0-1.8)
Capillaria sp	0	0.0 (0.0-1.2)	1	0.3 (0.0-1.8)
Protozoa				
Entamoeba coli	36	11.9 (8.5-16.1)	0	0.0 (0.0-1.2)
Endolimax nana	7	2.3 (0.9-4.7)	0	0.0 (0.0-1.2)
Giardia intestinalis	7	2.3 (0.9-4.7)	0	0.0 (0.0-1.2)
Chilomastix mesnilii	5	1.6 (0.5-3.8)	0	0.0 (0.0-1.2)
Blastocystis hominis	1	0.3 (0.0-1.8)	0	0.0 (0.0-1.2)
Coccidia sp	1	0.3 (0.0-1.8)	0	0.0 (0.0-1.2)
Total	**86**	**28.4 (23.4-33.8)**	**25**	**8.25 (5.4-11.9)**

N=total number of individuals examined, n = number of individuals infested by the parasite, (%) = prevalence, CI = Confidence Interval

4 Discussion

To our knowledge this study is the first of its kind to investigate the risks of zoonotic disease transmission of small mammals in urban human environments. Previous speculations have been made about the potential involvement of cockroaches, flies, and domestic rodents as disease vectors in communities (Etim *et al.*, 2013), but there is a lack of documented evidence on their role in the transmission of intestinal parasitosis in our country. The study focused on determining the intestinal parasitic infestations of small mammals captured in the commune of Abobo and assessing the prevalence of intestinal parasites with zoonotic potential. A total of 303 small mammals were captured and examined, with 101 individuals found infected, resulting in an overall prevalence of 33.3%, including 22.1% for helminths and 16.8% for intestinal protozoa.

The relatively high prevalence can be attributed to a lack of sanitation in the notoriously unhealthy commune of Abobo, where over 40% of waste remains uncollected (N'Guessan & Alla, 2019), leading to the proliferation of insects and rodents (Awoniyi *et al.*, 2021; Khalil *et al.*, 2021; Setiati *et al.*, 2021)in uncontrolled rubbish dumps, exposing small mammals to contamination with various kinds of parasites. Such conditions favor the transmission and infestation of these parasites.

Comparing the prevalence rates with other countries, the prevalence of 33.3% is higher than in 13.9% in Pakistan (Ahmad *et al.*, 2014) but lower than in Brazil and in Grenada (Indies), where rates of 73.6% and 79% were reported (Coomansingh-Springer *et al.*, 2019; Lima *et al.*, 2021)

These variations may be attributed to differences in the level of sanitation between the study sites and local ecological conditions influencing the epidemiology of parasites (Shah-Fischer & Say, 1989). Another study in Pakistan reported similar results with a prevalence of 33.3% (Garedaghi & Khaki, 2014) .

The observed high and significantly different prevalences of parasites in small mammals are noteworthy, as terrestrial anthropophilic small mammals are known to have a strong predisposition to intestinal parasites. For example, *Rattus rattus* and *Rattus norvegicus*, due to their lifestyle in sewers, rubbish bins, and landfill sites, are constantly exposed to infection with various pathogens. Conversely, *Mus musculus*, a commensal species living in close association with human structures (Cucchi *et al.*, 2020), is less exposed, which explains its low infection rate compared to other species. The lack of sex-related differences in parasite prevalence indicates that males and females had similar exposure to parasites (Seifollahi *et al.*, 2016) However, this finding contradicts a previous study in Brazil, which showed a higher infection rate in males (Lima *et al.*, 2021)

Among the helminth parasites, *Hymenolepis diminuta* was the most common (8.9%) among anthropophilic small mammals in the commune of Abobo. This is in line with the statement which states that with regard to zoonotic transmission of helminths, the role of rodents as reservoirs of *Hymenolepis nana* and *H. diminuta* stands out (Galán-Puchades *et al.*, 2018)

This finding is also consistent with previous studies conducted in Nigeria and Croatia, which also identified *Hymenolepis diminuta* as the predominant species (Biu *et al.*, 2021). The high prevalence of *Hymenolepis diminuta* may be attributed to potential intermediate hosts, such as the fleas *Xenopsylla cheopis* and the flour beetles *Tenebrio molitor*, commonly found in grain storage facilities (Coello-Peralta *et al.*, 2020).

The prevalence of intestinal protozoa (16.1%) is lower than reported in Nigeria and Iran (Mohebali *et al.*, 2017), but higher than in Brazil (Porta *et al.*, 2014; Lima *et al.*, 2021). The presence of zoonotic pathogens of the genera *Ancylostoma, Entamoeba, Giardia, Hymenolepis, Trichuris, Cappillaria, Enterobius,* and *Ascaris* highlights the potential risk to public health due to possible contamination of the environment by rodent droppings and the parasites they carry.(Aghazadeh *et al.*, 2015)

However, the study has some limitations, including the possibility of erroneous prevalence due to the use of Sherman traps, which are avoided by heavily parasitized Rattus species. The study did not consider external parasites, which are also of importance in both veterinary and public health contexts. Additionally, the diagnostic techniques used in the study may have limitations.

5 Conclusion

The anthropophilic ground-dwelling small mammals in Abobo exhibit a wide range of intestinal parasites. Notably, parasites of the genera *Ancylostoma, Entamoeba, Giardia, Hymenolepis, Trichuris, Cappilaria,* and *Enterobius* pose significant threats to public and veterinary health. Implementing improved hygiene practices and adopting preventive measures can effectively lower the risk of diseases transmitted by these small mammals, especially in areas where humans, livestock, and small mammals coexist closely. Local authorities are therefore called upon to consider implementing measures to control and manage the population of small mammals in the town by regulation, which will contribute to reducing the risk of transmission. Moreover, these data also provide information to medical practitioners for diagnosing possible zoonoses, and a reference point for more in-depth studies in urban environments in Côte d'Ivoire.

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