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Knowledge and Practices Regarding Pet Ownership and Parasitic Zoonoses among Medical Students and Faculty in Kabul, Afghanistan: A Focus on Toxocariasis

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ABSTRACT

Background: Toxocariasis is a common but often neglected parasitic zoonosis, transmitted mainly through contact with contaminated animals or soil. Despite its public health significance, awareness remains limited, particularly in Afghanistan. We aimed to assess the awareness and practices related to pet ownership and the risk of *Toxocara* infection among medical students and faculty members at two major private medical universities in Kabul.

Methods: This cross-sectional study surveyed 347 medical students and faculty members at Ghalib University and Cheragh Medical Educational Institute in Kabul between Oct and Dec 2023. A semi-structured questionnaire assessed sociodemographic factors, behaviors related to animal contact, and knowledge of zoonotic parasites, with a focus on *Toxocara*. Associations between pet ownership and knowledge or practices were examined using chi-square tests.

Results: Overall, 38.8% of participants reported owning pets. While 41.5% indicated high knowledge of zoonotic parasites, only 8.1% could name *Toxocara* specifically. Veterinary visits were common among pet owners. Pet ownership was significantly associated with sex, frequency of contact with stray animals, daily interactions with animals, knowledge of parasitic zoonoses, and awareness of the clinical spectrum (P<0.05). Hygiene practices after animal contact did not differ significantly between groups, although handwashing with water alone was most commonly reported. Knowledge regarding transmission routes, the ability to name parasites in general, zoonotic parasites, and *Toxocara* was similarly limited among both pet owners and non-owners.

Conclusion: Substantial gaps in knowledge about parasitic zoonoses, including *Toxocara*, were identified. Pet ownership influenced certain behaviors but did not consistently predict higher awareness. These findings underscore the need for targeted educational interventions to strengthen understanding and promote preventive measures among future healthcare professionals.

Keywords: *Toxocara*, Awareness, Medical students, Pet ownership, Afghanistan

Introduction

Toxocara infection is a widespread yet neglected zoonotic disease, with high seroprevalence reported across tropical, subtropical, and even industrialized

regions, particularly among children from socio-economically disadvantaged backgrounds (1). The infection is caused by the larval stages of the ascarid nematodes *T. canis* or *T. cati*, which inhabit the intestines of dogs and cats, respectively (2). Globally, the estimated prevalence of *Toxocara* is 11.1% in dogs and 17.0% in cats, with significantly higher rates found among young and stray animals, especially in rural settings (3, 4).

Humans are primarily infected via the fecal–oral route, often through direct contact with infected dogs and cats, as embryonated eggs can adhere to the animal fur (5). Infection may also result from ingestion of embryonated eggs present in contaminated soil, commonly found in public areas such as parks, or from inadequately washed vegetables (6, 7).

Various animals, including rodents, rabbits, birds, livestock, monkeys, earthworms, and cockroaches, can serve as paratenic hosts of *Toxocara*, harboring encysted larvae after ingesting embryonated eggs. These hosts do not allow parasite development but pose a transmission risk to definitive hosts or humans, particularly through the consumption of undercooked meat or organs (8).

In humans, *Toxocara* larvae hatch in the small intestine and cross the intestinal wall, from where they travel through the bloodstream to various organs, causing inflammation and tissue damage (9). The clinical spectrum includes asymptomatic infection to severe conditions, including visceral larva migrans (VLM), ocular larva migrans (OLM), covert toxocariasis (CovT), common toxocariasis (ComT), and neurotoxocariasis (NT) (10).

The global seroprevalence of *Toxocara* infection is approximately 19%, with regional variation: 38% in Africa, 34% in South-East Asia, 24% in the Western Pacific, 23% in the Americas, 11% in Europe, and 8% in the Eastern Mediterranean (2). In Iran, the weighted mean prevalence is 9.3% (11).

Despite its widespread prevalence and potential health impacts, *Toxocara* remains poorly recognized, even among healthcare professionals. In Saudi Arabia, only 27% of medical practitioners correctly identified *Toxocara* as a nematode, and 30% were aware of its clinical spectrum (12).

To date, there has been only one study on *Toxocara*—a 1988 post-mortem study in stray dogs in Kabul—with no recent data on human awareness or infection. We represent an initial effort to draw attention to this important but overlooked public health issue. We aimed to address this critical gap by assessing awareness and practices related to pet ownership and the risk of *Toxocara* infection among medical students and faculty members at two major private medical universities in Kabul, Afghanistan. Medical students have greater familiarity with these parasites through their curriculum; this investigation seeks to determine whether sufficient emphasis has been placed on these topics in their education.

Materials and Methods

Ethics Statement

Ethical approval for this study was obtained from the Ethics Committee of Ghalib University (reference code: 1398.1070). Before participating, all individuals were fully informed about the study's objectives and procedures and provided written informed consent.

Study Design and Setting

This was a cross-sectional study conducted in Kabul, the capital of Afghanistan, located in the eastern part of the country. The survey was conducted in the medical faculties of Ghalib University and Cheragh Medical Educational Institute. Faculties were selected based on accessibility and relevance to medical education. Kabul is one of the most densely populated cities in the country, characterized by a semi-arid continental climate.

Study Population

Overall, 347 medical students and faculty members from Ghalib University and Cheragh Medical Educational Institute participated in the study. The study population included undergraduate students from the 7th to 11th semesters and faculty members from various teaching departments. Students from these semesters were targeted because parasitology is typically taught in the 6th or 7th semester, ensuring they had prior exposure to the subject matter.

The required sample size was calculated using Cochran's formula, assuming a 95% confidence level, a 5% margin of error, and an expected proportion of 50%. For a target population of approximately 1000-2000 students and faculty members, the estimated sample size ranged from 278 to 322. To account for potential non-response, we aimed to collect data from approximately 350 participants. Overall, 347 valid responses were included in the final analysis.

Survey Instrument and Data Collection

The study was conducted between Oct and Dec 2023. A semi-structured questionnaire, developed by the investigators, was used for data collection. The questionnaire comprised three main sections:

(1) Sociodemographic characteristics (e.g., age, sex, occupational role, university affiliation);
(2) Behavioral characteristics (e.g., pet ownership, frequency of contact with stray animals, daily interaction with what type of animal, veterinary care for pets, and hygiene practices after animal contact);
(3) Knowledge of parasitic zoonoses, transmission routes, and clinical spectrum. This section also included an open-ended question asking participants to name any important parasite. For analysis purposes, responses to this item were reviewed, and two dichotomous variables were created in SPSS: one indicating whether any known zoonotic parasite was listed and another indicating whether the participant specifically mentioned *Toxocara*.

Responses to binary questions were recorded as "Yes" or "No". For knowledge-based questions with multiple answers, levels were categorized as 'No Knowledge,' 'Low,' 'Moderate,' or 'High,' based on the number of correct responses. Participants who named *Toxocara* in the last open-ended question were classified as "aware."

Statistical Analysis

Analyses were conducted using IBM SPSS Statistics ver. 23 (IBM Corp., Armonk, NY, USA), and a *P*-value<0.05 was considered statistically significant. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were calculated to summarize sociodemographic characteristics, knowledge levels, and practices. Chi-square tests were utilized to assess associations between pet ownership (owner vs. non-owners) and other variables.

Results

Totally, 347 individuals, including 307 students and 40 faculty members, participated from Ghalib University and Cheragh Medical Educational Institute. The majority were male (78.7%), with a mean age of 25.6 yr (SD ±1.8). Among the participants, 38.6% reported owning pets.

Most participants reported either moderate (39.5%) or low (38.6%) contact with stray animals. Daily interaction was more frequent with pet dogs and cats. After animal contact, the majority of participants reported washing their hands using water alone. Among pet owners, veterinary visits were common, with 37.3% reporting frequent and 39.6% occasional visits (Table 1).

Table 1: Descriptive analysis of the sociodemographic and behavioral characteristics

Variable	*Frequency*	*Percentage (%)*
Sex		
Male	273	78.7
Female	74	21.3
Occupation		
Student	307	88.5
Faculty	40	11.5
University		
Ghalib	192	55.3
Cheragh	155	44.7
Owns a pet		
Yes	134	38.6
No	213	61.4
Contact the stay animals		
High	47	13.5
Moderate	137	39.5
Low	134	38.6
No contact	29	8.4
Daily interaction with which animal?		
Pet dog	132	38.0
Pet cat	109	31.4
Stray dog	47	13.5
Stray cat	15	4.3
No contact	44	12.7
Hygiene practice after touching animals		
Water only	231	66.6
Water and detergent	73	21.0
Sanitizer	35	10.1
None	8	2.3
Frequency of veterinary visits		
Frequently	50	14.4
Occasionally	53	15.3
Rarely	27	7.8
Never	4	1.2
Not applicable	213	61.4

Regarding knowledge, 41.5% of participants reported a high level of awareness of zoonotic parasites, while moderate understanding was most common for transmission routes and clinical manifestations. Although 87.9% could name at least one parasite, only 34.9% identified zoonotic parasites, and 28 respondents specifically mentioned *Toxocara* (Table 2).

Table 2: Descriptive analysis of the knowledge of participants regarding zoonotic parasites & Toxocara

Variable	*Frequency*	*Percentage (%)*
Knowledge of Zoonotic parasites		
High	144	41.5
Moderate	123	35.4
Low	38	11.0
None	42	12.2
Knows transmission routes of parasitic zoonoses		
High	104	30.0
Moderate	140	40.3
Low	82	23.6
None	21	6.1
Knows clinical manifestations of parasitic zoonoses		
High	52	15.0
Moderate	153	44.1
Low	128	36.9
None	14	4.0
Named at least one parasite		
Yes	305	87.9
No	42	12.1
Named at least one zoonotic parasite		
Yes	121	34.9
No	226	65.1
Zoonotic Score		
0	226	65.1
1	98	28.2
2	17	4.9
3	5	1.4
4	1	0.3
Named *Toxocara*		
Yes	28	8.11
No	319	91.9

Associations with pet ownership

Associations between pet ownership and sociodemographic characteristics, behavioral factors, knowledge, and practices are summarized in Table 3. Sex was significantly associated with pet ownership (P=0.023). Female participants were proportionally more likely to report pet ownership compared to male participants. Contact with stray animals differed significantly between groups (P<0.001). Among pet owners, 25.4% reported high contact with stray animals compared to 6.1% of non-owners. Daily interactions with animals were also significantly associated with pet ownership (P<0.001). Pet owners more frequently reported daily contact with pet dogs (52.2% vs. 29.1%), while non-owners reported higher interaction with pet cats (37.1% vs. 22.4%).

Table 3: Pet owners vs Non-pet owners

Characteristics	***Owns a pet***		χ^2	***P-value***
	Yes N (%)	No N (%)		
Sex				
Male	97 (72.4)	176 (82.6)	5.142	0.023
Female	37 (28.6)	37 (17.4)		
Contact with strays				
High	34 (25.4)	13 (6.1)	28.189	<0.001
Moderate	49 (36.6)	88 (41.3)		
Low	45 (33.6)	89 (41.8)		
None	6 (4.5)	23 (10.8)		
Daily interaction with which animal?				
Pet dog	70 (52.2)	62 (29.1)	20.967	<0.001
Pet cat	30 (22.4)	79 (37.1)		
Stray dog	14 (10.4)	33 (15.5)		
Stray cat	3 (2.2)	12 (5.6)		
None	17 (12.7)	27 (12.7)		
Hygiene Practice after Touching Animals (cats/dogs)				
Water	86 (64.2)	145 (68.1)	5.124	0.163
Water + Detergent	25 (18.7)	48 (22.5)		
Sanitizer	18 (13.4)	17 (8)		
None	5 (3.7)	3 (1.4)		
Know Zoonosis				
High	56 (41.8)	88 (41.3)	9.643	0.022
Moderate	41 (30.6)	82 (38.5)		
Low	23 (17.2)	15 (7.0)		
No	14 (10.4)	28 (13.1)		
Know Transmission routes				
High	42 (31.3)	62 (29.1)	5.954	0.114
Moderate	54 (40.3)	86 (40.4)		
Low	35 (26.1)	47 (22.1)		
No	3 (2.2)	18 (8.5)		
Know clinical manifestations				
High	16 (11.9)	36 (16.9)	20.615	<0.001
Moderate	43 (32.1)	110 (51.6)		
Low	68 (50.7)	60 (28.2)		
No	7 (5.2)	7 (3.3)		
Named parasite				
Yes	118 (88.1)	187 (87.8)	0.005	0.941
No	16 (11.9)	26 (12.2)		
Zoonotic Score				
0	81 (60.4)	145 (68.1)	10.134	0.038
1	42 (31.3)	56 (26.3)		
2	6 (4.5)	11 (5.2)		
3	5 (1.9)	0 (0.0)		
4	0 (0.0)	1 (0.5)		
Named zoonotic parasites				
Yes	53 (39.6)	68 (31.9)	2.107	0.147
No	81 (60.4)	145 (68.1)		
Named Toxocara				
Yes	13 (9.7)	15 (7.0)	0.784	0.376
No	121 (90.3)	198 (93.0)		

Hand hygiene practices after touching an animal were not significantly associated with pet ownership (*P*=0.163). The majority in both groups reported using water alone, followed by water with detergent and hand sanitizer. Among pet owners (n=134), 37.3% reported frequent veterinary visits, 39.6% occasional, 20.1% rare, and 3.0% never.

Knowledge of parasitic zoonoses showed a significant association (*P*=0.022). High knowledge was reported at similar rates among pet owners and non-owners. However, a larger proportion of pet owners reported low knowledge, while most non-owners selected no knowledge.

No significant association was observed between pet ownership and knowledge of transmission routes (*P*=0.114). Both groups showed comparable distributions of high and moderate knowledge.

Knowledge of clinical manifestations differed significantly (*P*<0.001). Non-owners frequently reported moderate knowledge, while pet owners reported low knowledge.

There were no significant differences between groups in naming any parasite (*P*=0.941), naming zoonotic parasites (*P*=0.147), or naming *Toxocara* specifically (*P*=0.376).

However, the zoonotic score differed significantly (*P*=0.038). A higher proportion of pet owners achieved higher scores, with 1-3 zoonotic parasites named, while non-owners more frequently reported a score of 0.

Discussion

This study is the first in Afghanistan to assess knowledge and practices related to parasitic zoonoses, particularly toxocariasis, among medical students and faculty. Understanding these aspects among current and future healthcare providers is critical, as they play a pivotal role in diagnosing and managing parasitic infections, educating the public, and promoting preventive measures.

Most participants reported moderate to low contact with stray animals; however, even limited exposure poses a considerable risk of *Toxocara* transmission, as eggs can readily adhere to animal fur and be transferred through handling. This is supported by Overgaauw et al., who found higher concentrations of *Toxocara* eggs on the fur of healthy household dogs and cats than in their feces (13), suggesting that stray animals, rarely groomed, may harbor even higher levels of contamination. Daily interactions with pet dogs were common, and chi-square analysis confirmed that pet owners reported significantly more frequent contact. Dogs were the most commonly owned pets, aligning with cultural practices in Afghanistan and global trends reported by Statista (14). Despite widespread reports of hand hygiene following animal contact, participants relied on washing with water alone (Table 1), a practice that is insufficient to effectively remove zoonotic pathogens. Collectively, these findings underscore the need to promote proper handwashing techniques and other evidence-based prevention strategies to reduce zoonotic transmission risks. Our study found that most pet owners reported taking their pets to veterinary visits either frequently or occasionally, a finding consistent with studies from other countries, including Portugal (15). In contrast, only 13.8% of the pet owners in Egypt reported regular veterinary visits for their pets (16). This discrepancy may be attributable to our participants being medical students, who likely possess greater awareness of the importance of routine veterinary care.

Fewer than half of the participants reported a high level of knowledge regarding zoonotic parasites, and their understanding of transmission routes and clinical manifestations was generally moderate. Although the majority were able to recall at least one parasite, substantially fewer could

specifically identify zoonotic species, and recognition of *Toxocara* was particularly limited. This limited awareness is consistent with findings from other studies. For instance, a study in Saudi Arabia reported that only 27% of physicians correctly identified *Toxocara* as a nematode, with an even smaller proportion familiar with its clinical presentations (12). Similarly, related research among pediatricians indicated low confidence in their knowledge and an inability to describe appropriate prevention strategies (17). All respondents were affiliated with medical teaching institutions, such knowledge gaps are concerning and underscore the need to integrate more comprehensive content on parasitic zoonoses into medical curricula.

The practice of keeping dogs and cats as pets has become increasingly common worldwide, particularly during the COVID-19 pandemic (18). Afghanistan is gradually reflecting this trend. Traditionally, pet ownership was mainly limited to outdoor dogs, such as German Shepherds, kept for security. However, there has been a noticeable shift in attitudes, with more individuals expressing interest in keeping pets, especially various breeds of dogs and cats, for emotional support and companionship. However, as pet ownership becomes more widespread, it is essential to ensure that awareness of zoonotic diseases keeps pace with changing practices. This is particularly important given that, in low-income and rural areas, dogs and cats often act as major reservoirs of *Toxocara* species, contaminating the environment with infective eggs and thereby facilitating human infection (19).

Our findings showed significant associations between pet ownership and participants' sociodemographic characteristics, behaviors, and awareness of parasitic zoonoses. For example, a significant relationship was observed between sex and pet ownership, with females more likely to own pets, consistent with other studies (20, 21). Although the absolute number of male pet owners was higher due to the predominance of males in the sample, the proportion of females owning pets was significantly greater (28.6% vs. 17.4% among non-owners), indicating a higher likelihood of pet ownership among female participants.

A statistically significant association was identified between pet ownership status and the level of contact with stray animals. Notably, pet owners reported a substantially higher frequency of contact with strays compared to non-owners, attributed to greater familiarity or empathy toward animals. This finding aligns with results from other contexts, including a study conducted in the UK, where pet owners reported more frequent interactions with other dogs (22). Such increased contact underscores the need for targeted education on safe interactions with strays to reduce zoonotic transmission.

Although not statistically significant, our findings suggest that while the majority of both pet owners and non-pet owners reported practicing hand hygiene after animal contact, non-pet owners demonstrated slightly higher compliance with washing hands using water or detergent. This pattern aligns with observations that similarly reported lower handwashing compliance among pet owners (23), indicating that pet ownership may be associated with modest variations in hand hygiene behaviors following contact with an animal.

The distribution of knowledge levels regarding parasitic zoonoses differed significantly between pet owners and non-pet owners. Although the proportion of participants reporting high knowledge was similar in both groups, a substantial percentage of pet owners demonstrated no awareness. Pet ownership alone does not uniformly translate into greater awareness of zoonotic risk. It aligns with research from Egypt, where nearly half of pet owners lacked sufficient knowledge about parasitic zoonoses (16). Similarly, in Portugal, more than half of the participants reported being aware that diseases could be

transmitted from animals to humans, yet only 25.9% were familiar with the term ‘zoonosis’ itself (15). These findings underscore that owning pets does not inherently translate into adequate awareness of zoonotic risks. The persistence of knowledge gaps among pet owners may reflect limited access to targeted educational resources or an underestimation of the relevance of zoonotic diseases to personal and public health.

Pet owners demonstrated lower knowledge of clinical manifestations of zoonotic parasitic diseases, highlighting the need for targeted education on disease recognition and prevention. While knowledge of transmission routes did not differ significantly between pet owners and non-owners, a higher proportion of non-owners lacked awareness entirely. Both groups showed comparable ability to name parasites, zoonotic parasites, and specifically *Toxocara*; however, the majority of the participants, regardless of pet ownership status, were unable to list zoonotic parasites and *Toxocara*. These findings indicated widespread gaps in foundational knowledge of parasitic zoonoses among medical students and faculty. Given their future roles in public health education and clinical care, improving awareness in this population is essential to improve early recognition, prevention strategies, and public communication regarding zoonotic risks.

This study has several strengths. It included both students and faculty members across two major medical institutions, with a sample size large enough to provide a robust overview of prevailing knowledge and practices. The structured questionnaire captured both behavioral and knowledge-related domains relevant to zoonotic parasite risk.

However, some limitations should be acknowledged. First, the cross-sectional design precludes establishing causal relationships between knowledge and practices. Second, responses were self-reported and may be subject to recall or social desirability bias. Third, the study was conducted in only two universities in Kabul, which may limit the generalizability of the findings to other regions of Afghanistan. Additionally, while the questionnaire was investigator-developed, further psychometric validation in this context would enhance its reliability.

Despite these limitations, the findings highlight the urgent need to strengthen medical curricula to enhance knowledge and preventive practices related to toxocariasis and other parasitic zoonoses among current and future healthcare professionals. Integrating targeted training modules aligned with WHO’s “Neglected Zoonotic Diseases” guidelines, featuring case-based learning and hands-on sessions in parasite identification and prevention, could significantly reduce the risk of transmission in both clinical and community settings.

Conclusion

This study highlights significant gaps in awareness and practices related to parasitic zoonoses, particularly toxocariasis, among medical students and faculty members in Kabul, Afghanistan. While pet ownership and medical training influenced certain behaviors and knowledge, they did not ensure a comprehensive understanding of zoonotic risks. Given the role of healthcare professionals in prevention and community education, integrating targeted training modules on zoonoses into medical curricula is crucial. Strengthening awareness of transmission routes, clinical manifestations, and effective preventive practices, including hygiene and veterinary care, will help mitigate the risk of infection. Importantly, this work serves as a baseline assessment to guide larger, more comprehensive studies across Afghanistan and inform targeted public health interventions. By drawing attention to the neglected issue of *Toxocara* infection, it aimed to raise awareness and encourage

researchers, educators, and policymakers to pursue rigorous investigations and evidence-based strategies to reduce the underdiagnosis and improve disease control.

Data availability

All datasets are included within the paper. Any question may be obtained from the corresponding author upon request.

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Conflict of interest

The authors declare that there is no conflict of interests.

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