

Research



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Knowledge, perception, and practices concerning toxoplasmosis among veterinary students in Kumasi, Ghana

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Abstract

Introduction: toxoplasmosis is one of the most neglected infectious diseases in Ghana and many other sub-Saharan countries. It has a high prevalence in Ghanaian society, yet it has not received the needed attention in terms of public education and awareness creation. Veterinary students are potentially at risk of infection due to their frequent contact with animals, including cats during their training. **Methods:** a cross-sectional study, utilizing a well-structured closed-ended questionnaire administered to 231 veterinary students who were randomly selected from Kwame Nkrumah University of Science and Technology, Kumasi, Ghana, was conducted to assess student knowledge, perception, and

practices on toxoplasmosis. The students were of varied demographic characteristics and in different years of studies. The Pearson Chi-square test was used to evaluate the statistical differences between the demographic characteristics, knowledge, perception and practices towards toxoplasmosis among veterinary students.

Results: the study recorded 115 (49.8%) respondents had high knowledge of the disease, 58 (25.1) had moderate knowledge and the majority of the students in the clinical years had better knowledge in comparison to those in the pre-clinical years. Regarding perception, 89 (38.5%) respondents had a moderate perception of the disease being zoonotic and highly contagious, 86 (37.2%) had a low perception and only 56 (24.2%) had a high perception. The majority 168 (72.7%) of the respondents do not practice safety measures that prevent them from coming into contact with the parasites such as washing of hands after touching cat litter and eating well-cooked foods.

Conclusion: this study has established a gap in knowledge, perception, and preventive practices relating to toxoplasmosis among veterinary students of KNUST, hence the need to intensify awareness creation among the students right from the first year of the 6-year veterinary medicine program.

Introduction

Toxoplasmosis is a zoonotic protozoan infection caused by the obligate intracellular parasite called *Toxoplasma gondii*, with felids as the definitive host [1]. *Toxoplasma gondii* was first discovered in 1908 by Nicolle and Manceaux. *Toxoplasma gondii* is ubiquitous, non-host specific and infects a wide range of mammalian hosts, including humans, pets, and livestock [2]. Toxoplasmosis is of great importance in both veterinary and human medicine due to the role it plays in causing the abortion of fetuses in humans and animals [3]. In 1939, it was first medically reported but became known in veterinary medicine in 1957 when it caused abortion storms in sheep [4]. It is estimated that about 20% to 90% of the world's

adult population have had contact with the parasite, with seropositivity rates ranging from 10% to over 90% in the world's human population [5]. In the USA and the UK, it has been estimated that between 10% and 40% of the population is infected [6].

Toxoplasmosis is one of the most neglected infectious diseases in Ghana and many other sub-Saharan countries. A study conducted by Bentum *et al.*, [7] and Antwi *et al.*, [8] confirmed the existence of toxoplasmosis in small ruminants in Ghana. The moderately high prevalence of toxoplasmosis in Ghana may be attributed to the tropical climatic conditions suitable for the parasite's survival; and such activities like pet keeping, contact with soil, poor sanitation, free-ranging animals, and lack of hand hygiene, all of which aid the prevalence of the parasite [9]. A study conducted at the Kwame Nkrumah University of Science and Technology (KNUST) hospital reported an overall seroprevalence of 50.3% with 41.1% of that number being pregnant women [10].

Even though the disease is of great public health importance, it has not received as much attention in terms of public awareness and education as other zoonotic diseases like rabies and tuberculosis. Toxoplasmosis is also reported to be one of the most common causes of foodborne parasitic disease in humans [5]. Toxoplasmosis is an occupational risk for veterinarians, veterinary students, farmers, and abattoir workers who handle infected animals and meat. In Ghana, seroprevalence studies for toxoplasmosis in farm animals indicated seropositivity of 39% in pigs, 26.8% in goats, and 33.2% in sheep [7].

Veterinary medical students, interns in clinics and on farms, during vacations as part of the veterinary training, handle animals to acquire more knowledge by way of hands-on practice. As such, there is a high possibility of them getting infected with the parasite. This study, therefore, aims to assess knowledge, perception, and preventive practices concerning toxoplasmosis

among veterinary medical students at KNUST, which will, in turn, provide data to aid in public policies on awareness creation concerning the disease.

Methods

Study area: the study was conducted at the School of Veterinary Medicine (SVM), Kwame Nkrumah University of Science and Technology (KNUST), Kumasi, Ghana.

Location of the study area: Kwame Nkrumah University of Science and Technology, Kumasi is located between longitudes 1.5716° W and latitudes 6.6745° N with GPS coordinates of 6° 40' 23.4300" N and 1° 33' 55.5228" W. The School of Veterinary Medicine at KNUST is a constituent of the College of Health Sciences. It has a current (2022) student population of three hundred and eighteen (318).

Study design: a cross-sectional study using a close-ended questionnaire was designed and applied to collect the required data. The study was conducted from June 2022 to August 2022.

Questionnaire development: the questionnaire was developed to obtain information on the demographic characteristics of participants, their knowledge, perception, and practices regarding toxoplasmosis.

Study population: all students at the School of Veterinary Medicine, KNUST, were included in the selection for the study.

Sample size: the selection of participants was solely based on the willingness of students to participate in the study. A total of 231 students participated in the study. Distribution of participants according to level (year) of studies is: 71 participants were from year 1, 77 from year 2, 34 from year 3, 16 from year 4, 17 from year 5, and 16 from year 6.

Data collection: the questionnaire was piloted on 12 students (two students from each academic year) and reviewed for clarity before implementation. The final version had three sections: demographics of participants, knowledge of toxoplasmosis, and perception and practices regarding toxoplasmosis.

Demography and key information: the first section collected demographic information such as the student's age, gender, marital status, academic year (level), and ownership of animals, including cats.

Knowledge: this comprised questions to assess whether or not the student has any knowledge of the disease. Any correctly answered question on knowledge was scored one (1) mark. A sum of nine (9) marks was scored for all correctly answered questions. Zero (0) to three (3) was interpreted as low knowledge; four (4) to six (6) as moderate knowledge; seven (7) to nine (9) as high knowledge.

Perception: questions in this section assessed students' way of thinking concerning toxoplasmosis. Any correctly answered question on perception was scored one (1) mark. The perception was based on agree, disagree, and unsure. A sum of nine (9) marks was scored for all correctly answered questions. Zero (0) to three (3) was interpreted as low; four (4) to six (6) as moderate; and seven (7) to nine (9) as high.

Practices: this section comprised questions that assessed the actual application of knowledge on toxoplasmosis to prevent infection. A total of 12 marks were scored for all correctly answered questions. Zero (0) to four (4) was interpreted as poor practices; five (5) to eight (8) as good practices; and nine (9) to twelve (12) as excellent practices.

Data analysis and presentation: data collected were entered into Microsoft Excel version 2019 and cleaned by ensuring the responses were rightly given. All incomplete questionnaire

responses were eliminated to avoid data inconsistencies and mistakes. The cleaned Excel Data was subsequently uploaded to the Statistical Package for Social Science (SPSS) Software version 26.0 for data analysis. The descriptive analysis of the demographic characteristics was performed and results presented in frequencies and percentages. Pearson Chi-Square test was conducted to ascertain the statistical significance between the effects of demographic characteristics on the knowledge, perception and practices in relation to toxoplasmosis. Statistical significance was tested at 5% significant level or 95% confidence interval. All significance values less than or equal to 0.05 were considered to be statistically significant.

Results

Demographic characteristics

Out of 318 questionnaires that were distributed to the students of the School of Veterinary Medicine, KNUST, 231 responded, with a 72.6% response rate and zero (0) exclusion or incomplete questionnaire. The mean age of respondents was 20.11 ± 1.13 years. The highest proportion of respondents (182; 79%) was from the pre-clinical years (year one to year three). More than half of the respondents (187) representing 81% were from urban areas. Almost all students 224 (97.0%) were single, while 5 (2.2%) were married. Furthermore, 134 (58%) respondents had animals at home, out of which 58 (25.1%) owned cats as shown in Table 1.

Awareness and source of information on the disease

Out of the 231 respondents across all year groups, the majority (116, representing 50.2%) had not heard of the disease. The rest 115 (49.8%) had heard of the disease with 69.6% of them being in school during class work or through research assignments. The remainder claimed to have heard of it from other sources including reading from books/articles (1.7%), internships (4.3%), at

home (7%), TV (7.8%), internet (8.7%), and conferences (0.9%) (Table 2).

Knowledge, perception, and practices

From Table 3, 115 respondents, representing 49.8%, had high knowledge of the disease; 58 (25.1%) respondents had low knowledge and another 58 (25.1%) had moderate knowledge of the disease. The results also show that 89 (38.5%) respondents had a moderate perception of the disease being zoonotic and highly contagious, 86 (37.2%) had a low perception and only 56 (24.2%) had a high perception (Table 3). The majority, 168(72.7%), of the respondents practiced poor safety measures that prevent them from getting infected with the disease. Only 63 (27.3%) of the respondents reported good practices such as washing of hands after touching cat litter and eating well-cooked foods to prevent getting infected with the disease (Table 3).

Association between gender, place of residence, and knowledge

From Table 4, the majority of the males showed high knowledge 83 (58.0%), 36 (25.2%) showed moderate knowledge and 24 (16.8%) showed low knowledge. Highest number of female respondents 33 (37.9%) showed low knowledge, 32 (36.8%) showed high knowledge and 22 (25.3%) showed moderate knowledge. The p-value of 0.001 shows that the gender of respondents has a significant influence on knowledge of toxoplasmosis. From the table, it is evident that the majority of respondents from both urban and rural areas had high knowledge of the disease 96 (51.3%) and 19 (43.2%) respectively. However, according to the Fisher exact test, the association was not statistically significant.

Table 4 also shows that the highest number of male respondents, 58 (40.6%), had moderate perception; 44 (30.8%) had low perception and 41 (28.7%) had a high perception. Majority of female respondents, 41 (47.1%), showed low perception; 31 (35.6%) showed moderate perception and 15

(17.2%) showed high perception. The results demonstrated that the gender of respondents is not a factor that significantly influences the perception of toxoplasmosis ($p = 0.032$). Seventy-four (39.6%) respondents from urban areas had moderate perception, 70 (37.4%) had low perception and 43 (23%) had high perception; whereas 16 (36.4%) respondents from rural areas had low perception, 15 (34.1%) had moderate perception and 13 (29.5%) have high perception. According to Fisher's exact test, the association is statistically insignificant ($p = 0.466$). In addition, students living in both rural and urban areas did not practice good preventive measures that limit the risk of infection with the pathogen. However, using Fisher's exact value, the relationship was not statistically significant ($p = 0.278$) (Table 4). This meant that place of residence had no influence on respondents' preventive practices regarding toxoplasmosis.

Association between knowledge, perception and practices

From Table 5, the majority of respondents with low knowledge showed low perception (89.7%), the majority of those with moderate knowledge also showed moderate perception (46.6%), but the majority of those with high knowledge showed moderate perception (49.6%). Using Fisher's exact value where $p < 0.05$, it shows that the association is statistically significant meaning respondents' knowledge influences their perception of the disease.

Data in Table 5 also revealed that the majority of those with low knowledge showed low practice (81%), the majority of those with moderate knowledge also showed bad practice (75.9%) and the majority of those with high knowledge also showed bad practice (67%). Using Fisher's exact value, it shows that, the relationship is statistically insignificant, meaning that the knowledge of respondents regarding toxoplasmosis does not influence their practices that would prevent them from getting infected with the pathogen.

Discussion

Good knowledge and awareness of toxoplasmosis infection are essential factors to decrease infection rates and congenital toxoplasma infection. However, a change in attitude and behavior is more essential than acquiring more knowledge [11]. The low knowledge relating to toxoplasmosis leads to a decline in achieving prevention goals realization. Social education is an essential factor required for the change of attitudes of people. People need continuous knowledge on toxoplasmosis transmission and more importantly, education on simple practices that aid in preventing infection and disease [12]. This study was undertaken to evaluate the level of knowledge, perception, and practices towards toxoplasmosis among students of the School of Veterinary Medicine, KNUST. The different academic year levels of the students in the survey played a role in the variation observed regarding knowledge of the disease.

This study revealed that the percentage of veterinary students who were aware of toxoplasmosis was 49.8 % (115) out of 231 students who participated in the study. Regarding the source of information, more students (34.6%) reported that they had acquired knowledge of the disease in school during lectures or by class assignments than from other sources. This is similar to work done by Ait *et al.*, [13] in Rabat, Morocco. In Yemen, Al-Naggar *et al.*, [14] reported that the majority of respondents acquired knowledge from the Internet. In contrast, a study done in Iran in 2013 reported that the most important source of information for the participants was books (55.8%). The primary source of knowledge is vital as it gives an idea concerning where one is more likely to hear about toxoplasmosis. This study revealed that aside from lectures and class assignments in tertiary institutions, it is very unlikely for ordinary Ghanaians to hear about the disease. Being a disease of public health importance, more efforts should be channeled into general public

awareness of the disease through television and radio broadcasts, social media, and local announcement platforms.

The present study also investigated whether gender influenced the knowledge of the disease. This was because the disease is reported to have a larger impact on females than males with abortions being of the utmost concern [6]. A study conducted at the KNUST Hospital revealed a seroprevalence of 57.3% for toxoplasmosis among pregnant women [6]. In this study, more male students (40.5%) demonstrated knowledge of the disease than female students (36.7%). In Iran, Nematollahi *et al.*, [15] had similar results with higher knowledge percentage in male students than female students (41% and 13.9%), respectively. Similarly, in Iran, Ebrahimi *et al.*, [16] reported that more male students were aware of the disease (17.3%) than female students (13.8%). A contrast was seen in comparison with work done in Morocco by Ait *et al.*, [13], where more females (47.2%) were aware of the disease than males (36.9%). The disparity in awareness with respect to gender differences, require intensified social awareness of the risks and complications associated with toxoplasma infection, to reduce infections and transmission.

This study shows that place of residence did not influence knowledge, perception, and practices that could prevent infection. Students from both urban and rural communities showed relatively high knowledge, moderate perception, and poor preventive practices. This is contrary to reports by Ebrahimi *et al.*, (2015) [16] in the University of Mashhad, Iran, where people from urban and rural areas showed low knowledge of toxoplasmosis. In Egypt, Senosy, [17] reported a higher rate of good knowledge among students from rural areas in comparison with those from urban areas. Regarding the relationship between the academic year (level) of study and the knowledge of students on the disease, we found that clinical-year students were more aware of toxoplasmosis than pre-clinical-year students. This result is similar to that of Ait *et al.*, [13] where students in

the medical field knew more than students in the other fields. This variation can be due to the course contents at each phase of the veterinary program. More attention is given to public health and other health-related courses in the clinical years than in the pre-clinical years.

The results of this study showed that knowledge of the disease did not necessarily translate into good practices to prevent the disease as observed by the overall respondents' scores with high knowledge but poor practices. This reinforces the point earlier made that a change in attitude and behavior is more essential than acquiring more knowledge [11]. Students, and by extension, the general public should be educated on the need to observe good practices to prevent infection with the pathogen.

Conclusion

This study establishes that the minority 115 (49.8%) of the participants have heard of toxoplasmosis. The majority of those who had heard of the disease were mostly clinical-year students. The major source of information on the disease, as indicated by the participants, was at school through lectures and class assignments. The study also establishes that the majority of respondents across all year groups perceived the disease to be moderately dangerous and highly contagious. Moreover, more than half of the participants' practices regarding the prevention of toxoplasmosis were found to be poor hence inadequate. The knowledge of respondents did not influence their practices. Except for the gender and age of respondents, all other sociodemographic characteristics were not factors that had any significant influence on their knowledge, perception, and preventive practices. This study, therefore, concludes that there is a gap in knowledge, perception, and preventive practices regarding toxoplasmosis among students of the School of Veterinary Medicine, KNUST, Kumasi. Accordingly, it is recommended that emphasis on toxoplasmosis education, including,

preventive practices should be improved, since it is zoonotic. Therefore, veterinary students are at a high risk of infection, especially during practical sessions when handling animals and essentially cats.

What is known about this topic

- *Toxoplasmosis is a major zoonotic disease worldwide that affects humans and animals with serious implications, especially for humans;*
- *In Ghana and many other sub-Saharan countries, this disease is one of the most neglected infectious diseases;*
- *Despite the public health significance, it has not received as much attention in terms of public awareness and education as other zoonotic diseases like rabies and tuberculosis.*

What this study adds

- *This study adds to the existing literature on the knowledge of toxoplasmosis in Ghana among veterinary students;*
- *It provides critical information on the perception of the disease among veterinary students and their current practices;*
- *The study also indicates strongly the need for awareness creation on the disease in the veterinary curriculum, especially from the first year.*

Competing interests

The authors declare no competing interests.

Authors' contributions

Conceptualization by Raphael Folitse and Dorcas Oyueley Kodie; data gathering by Samuel Arkaifie; statistical analysis by Vitus Burimuah and William Tasiame; manuscript drafting and editing by Samuel Arkaifie, Raphael Folitse and Benjamin

Obukowho Emikpe. All author have read and agreed to the final manuscript.

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Table 1: demographic characteristics of participants

Variable	Categories	Frequency (n)	Percentage (%)
Gender	Male	143	61.9
	Female	87	37.7
	Prefer not to answer	1	0.4
Age (years)	18 - 19	56	24.2
	20 - 21	90	39.0
	22 - 23	43	18.6
	24 - 25	27	11.7
	>25	15	6.5
Marital status	Single	224	97.0
	Married	5	2.2
	Divorced	2	0.9
Level of studies	Level 100	71	30.7
	Level 200	77	33.3
	Level 300	34	14.7
	Level 400	17	7.4
	Level 500	16	6.9
	Level 600	16	6.9
Place of residence	Urban	187	81.0
	Rural	44	19.0
Pet ownership	Yes	134	58.0
	No	97	42.0
Which animal(s)	No animals	97	42.0
	Cat	58	25.1
	Other animal(s)	76	32.9
How long have you kept the pet?	1 year	17	7.4
	2 years	31	13.4
	3 years	15	6.5
	4 years	9	3.9
	> 4 years	62	26.8

Table 2: awareness of toxoplasmosis and the source of information

Variable	Categories	Frequency	Percent
Heard of toxoplasmosis	No	116	50.2
	Yes	115	49.8
Source of information for respondents who have heard about Toxoplasmosis	School	80	69.9
	TV	9	7.8
	Internet	10	8.7
	Conference	1	0.9
	Home	8	7.0
	Books/ Articles	2	1.7
	Internships	5	4.3

Table 3: result for level knowledge, perception, and practices on *Toxoplasmosis gondii*

Variable	Frequency (N)	Percentage (%)
Level of knowledge		
Low knowledge	58	25.1
Moderate knowledge	58	25.1
High knowledge	115	49.8
Level of perception		
Low perception	86	37.2
Moderate perception	89	38.5
High perception	56	24.2
Level of practices		
Poor practices	168	72.7
Good practices	63	27.3

Table 4: association between gender, place of residence and knowledge, perception and practices

Association between gender, place of residence and knowledge					
	Low Knowledge	Moderate Knowledge	High Knowledge	Total (100%)	p-value
Male	24 (16.8%)	36 (25.2%)	83 (58.0%)	143	0.001
Female	33(37.9%)	22(25.3%)	32 (36.8%)	87	
Prefer not to answer	1(100.0%)	0(0.0%)	0(0.0%)	1	
Urban	44 (23.5%)	47(25.1%)	96 (51.3%)	187	0.638
Rural	14 (31.8%)	11(25.0%)	19 (43.2%)	44	
Association between gender, place of residence and perception					
	Low Perception	Moderate Perception	High Perception	Total	p-value
Male	44 (30.8%)	58 (40.6%)	41 (28.7%)	143	0.032
Female	41 (47.1%)	31 (35.6%)	15 (17.2%)	87	
Prefer not to answer	1 (100)	0	0	1	
Urban	70 (37.4%)	74 (39.6%)	43 (23.0%)	187	0.466
Rural	16 (36.4%)	15 (34.1%)	13 (29.5%)	44	
Association between place of residence and practice					
	Low practices	Moderate practices	High practices	Total	p-value
Urban	0	133(71.1%)	54(28.9%)	187	0.278
Rural	0	35(79.5%)	9(20.5%)	44	
Total		168(72.7%)	63(27.3%)	231	

P-value <0.05 is significant, fishers Exact test.

Table 5: association between knowledge, perception and practices

Association between Knowledge and Perception					
	Low perception	Moderate perception	High perception	Total	p-value
Low Knowledge	52 (89.7%)	5 (8.6%)	1 (1.7%)	58	0.000
Moderate Knowledge	26 (44.8%)	27 (46.6%)	5 (8.6%)	58	
High Knowledge	8 (7.0%)	57 (49.6%)	50 (43.5%)	115	
Total	86 (37.2%)	89 (38.5%)	56 (24.2%)	231	
Association between Knowledge level and Practice					
	Poor practices	Good practices	Total	p-value	
Low Knowledge	47 (81.0%)	11 (19.0%)	58	0.134	
Moderate Knowledge	44 (75.9%)	14 (24.1%)	58		
High Knowledge	77 (67.0%)	38 (33.0%)	115		
Total	168 (72.7%)	63 (27.3%)	231		

P-value <0.05 is significant, fishers Exact test