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Research Article

Toxoplasmosis among the University of Tripoli Students: Knowledge and Risk Factors

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Abstract

Background: Studies have proven a high increase in the prevalence of toxoplasmosis in North African countries, which highlights the need to investigate the degree of awareness among Libyan medical school students of toxoplasmosis and associated risk factors for getting the infection. Primarily, a few studies have evaluated the degree of knowledge on toxoplasmosis among females in Saudi Arabia.

Aim: This study aimed to evaluate the awareness of toxoplasmosis and its risk factors among undergraduate students at the Medical Faculties at the University Of Tripoli, Libya (UOT).

Subjects and methods: A cross-sectional design with a multi-stage random sample of male and female students in the Medical Faculties at the UOT was recruited in this survey for three months using a self-administrated questionnaire including demographic characteristics, epidemiological and risk factors related to toxoplasmosis.

Results: Among 268 students, (86.4%) were medical students, and (13.6%) were pharmacy students. Out of 268 students (76.5%) were female, and (23.5%) were male. Results showed that (79.5%) were aware of toxoplasmosis and its risk factors. For most of them, the faculty curriculum was their source of information. This study showed that some students risk getting toxoplasma gondii infection as (37.3%) are cat owners and (36.6%) do not follow the proper measures for changing cat litter boxes. However, some students practice some preventive measures, as they do not eat semi-cooked meat (74.3%), do not consume unpasteurized milk (79.1%), and wash fruits and vegetables before consumption (94%).

Conclusion: The current study proved that the negative attitude toward toxoplasmosis generates a critical need for improving the educational system. Attempts toward raising awareness to take preventive measures are crucial to avoid the infection, especially in pregnant women, to prevent congenital infection and severe complications of infection in immunocompromised patients.

Keywords: Toxoplasmosis; Tripoli; Students; Knowledge; Risk Factors

Introduction

An obligatory intracellular protozoon (Toxoplasma gondii) is the cause of toxoplasmosis. It is considered one of the most essential blood and tissue protozoa. It was first identified by Nicolle and Manceaux in 1908 in Tunisia, where the toxoplasma was found in a North African rodent, gundi (Ctenodactylus gundi) [1]. Since then, it has been identified as a zoonotic parasite [2]. Toxoplasmosis is a cosmopolitan infection. Approximately a third of the world's population is infected with this protozoan [3]. The cause of this high prevalence can be explained by the environmentally resistant stage of the parasite, the oocyst [4]. It has been shown that the prevalence can vary from 1% in Alaska to 90% of populations in France have been infected with Toxoplasma [5]. Toxoplasma has a complex life cycle, where humans and animals can act as intermediate hosts; causative factors to toxoplasma's prevalence variation worldwide are eating habits, variation in climate and contact with infected cat feces, and ingestion of mature oocysts [6]. Infection with toxoplasma is usually asymptomatic [7]. However. It can cause a spectrum of clinical manifestations ranging from mild symptoms in immunocompetent patients to life-threatening squeals in immunocompromised patients including myocarditis, chorioretinitis, and encephalitis [8,9]. and congenital toxoplasmosis as a consequence of intrauterine fetus infection, the severity of congenital infection depends on the period of pregnancy at which the pregnant woman acquired the infection [10]. The infection during the first trimester carries low congenital risk (10-15%). Meanwhile, the infection during the third trimester carries a high congenital risk (60-90%). However, the first trimester's infection carries the most catastrophic congenital manifestations [2].

Toxoplasma gondii, is associated with inflammation in the heart tissue and psychiatric effects of individuals with intact immune systems [11-14]. recent studies have identified a correlation between toxoplasmosis and conditions like myocarditis and pericarditis, suggesting immune dysregulation as a likely mechanism. Notably, a study by Wang., *et al.* (2018) found evidence of T. gondii DNA within the cardiac tissue of patients with myocarditis, bolstering the connection between the parasite and cardiac inflammation [15]. Additionally, psychological disorders such as anxiety, depression, and schizophrenia have been linked to toxoplasmosis, likely attributed to its ability to affect neurotransmitter systems in the brain. A meta-analysis by Sutterland., *et al.* (2015) highlighted a significant association between T. gondii infection and heightened risk of schizophrenia, underscoring the psychiatric implications of toxoplasmosis [16]. Furthermore, this protozoan parasite has been reported to be transmitted through blood transfusion of whole blood and white blood cells from healthy seropositive donors (especially those who are in an acute phase of the infection) to seronegative recipients and organ transplantation [17-19].

These findings stress the importance of providing sufficient information about toxoplasmosis and its risk factors is proven to be a critical preventive measure. Numerous studies have been conducted to evaluate the global understanding of toxoplasmosis. This study evaluates students' risk behaviour, preventative strategies, and toxoplasmosis awareness.

Subjects and Methods

Study Design

A cross sectional study was designed to assess the awareness of toxoplasmosis and its risk factor among medical students.

Study area and population

This study was conducted in July 2023 among male and female Medical and Pharmacy students in Medical Faculties of at UOT.

The sample size was estimated using the formula recommended by the World Health Organization [20].

The following criteria were established: the adequate knowledge rate at 50%, the confidence level at 95%, and the margin of error at 5%.

The total number of students involved in this study was 268 according to the following criteria: students who agreed to be involved in this study and completed the questionnaire.

Questionnaire sheet

A well-structured questionnaire (Appendix 1) was designed in English, including biographical data: age, current education level, social status, and pregnancy. Also, it includes questions about the knowledge of toxoplasmosis and its risk factors, including raising cats, handling cat litter, ingestion of raw or undercooked meat, using gloves when dealing with meat, washing fruits and vegetables before eating them, source of water and milk, and contacting with garden soil. This questionnaire was tested first in a pilot study that was not included in the current study. Then, it was distributed among participants, preceded by an oral briefing for the aim of the study.

Results

Results of the general sociodemographic data of the university students show that 268 students from two colleges in the UOT (Faculty of Medicine and Faculty of Pharmacy) were involved in this study.

Most participants (83.201%) were from the Faculty of Medicine and (and 16.79%) were from the Faculty of Pharmacy. The average age is (22.8), of whom 76.5% (205/268) were female and 23.5% (63/268) were male (Table 1). Most students were not married (95.5%), and about (1.9%) of married students got abortions.

Variable	Responses	Yes		No		Total		P-Value
Knowledge about toxoplasmosis	Count	213		55		268		0.702
		Male 49	Female 164	Male 14	Female 41	Male 63	Female 205	
	Percentage %	79.5%		20.5%		100%		

Table 1: Knowledge about Toxoplasmosis.

Among the 268 students interviewed during this survey, (20.5%) of the participants were unaware of toxoplasmosis, while (79.5%) were aware of the causative parasite, of which 77% (49/63) were male and 80% (164/205) were female. However, this difference is not statistically significant.

Furthermore, our results showed a statistically significant positive correlation between the level of knowledge about toxoplasmosis and the faculty of the participant's answers about having heard of the disease. We found that medical students knew more about toxoplasmosis than the students of the faculty of pharmacy ($p < 0.005$) (Table 2).

Variable	Responses	Faculty of Medicine	Faculty of Pharmacy	P-value
Knowledge about toxoplasmosis regarding the college	Yes	184 (86.4%)	29 (13.6%)	0.006
	No	39 (70.9%)	16 (29.1%)	

Table 2: Knowledge about toxoplasmosis regarding the college.

Concerning the students' exposure to the potential risk factors of toxoplasma infection, most students (62.7%) do not have cats as pets, and (36.2%) of the cat owners handle the cats and clean their litter boxes.

Furthermore, (6.7%) of the students need to wash their fruits and vegetables before eating. Also, a quarter (25%) of students sometimes eat raw or semi-cocked meat. Additionally, most students (about 80%) do not wear gloves when dealing with meat, and (20.9%) drink unpasteurized milk.

Bottled water was the primary source (62.3%), while untreated water was used (37.6%).

Also, (60%) of the students have no contact with garden soil at home, while (40%) of the participants have intermittent contact with garden soil.

Discussion

Toxoplasmosis is a self-limiting disease, but it can lead to catastrophic results in pregnant women and immune-compromised patients [21]. Therefore, one of the most crucial methods in preventing the risk of toxoplasma transmission is the improvement of awareness and knowledge of toxoplasmosis.

Hence, the percentage of students who were aware of toxoplasma gondii infection was (79.5%), which was higher than that reported in Egypt (3.2%) [22], Morocco (42.6%) [23], Yemen (50%) [24], in Jordan (51.1%) [25] and in Saudi Arabia (20.9%) [26]. The variation in the knowledge of the toxoplasmosis may be explained by different target students in this study. Most students who were previously aware of toxoplasmosis stated that they learned about it in the classroom throughout their studies.

Variables	Responses	Number of students	Percentage %
Ownership of cats	Yes	100	37.3%
	No	168	62.7%
Handling cats and changing cat's litter box.	Yes	98	36.6%
	No	170	63.4%
Washing fruits & vegetables before eating	Yes	254	94%
	No	16	6%
Eating raw or semi cocked meat	Yes	69	25.7%
	No	199	74.3%
Wearing gloves when dealing with meat	Yes	55	20.5%
	No	213	79.5%
Drinking unpasteurized milk	Yes	56	20.9%
	No	212	79.1%
Source of drinking water	Bottled water	170	63.4%
	(other)Untreated water and tape water	98	36.6%
Contact with garden soil	Yes	110	41%
	No	158	59%

Table 3: Exposure of student to toxoplasma risk factor.

This is like the response of the students in Rabat in, Morocco [23]. Meanwhile, the main source of knowledge about toxoplasmosis was the internet, which is reported in Saudi Arabia and Yemen [24,27]. The relationship between knowledge about the disease and their gender is that fewer male students (77%) than female students (80%) were aware of toxoplasmosis. Similarly, Hamou., *et al*. (2021) reported that fewer male students were aware of toxoplasmosis (36.9%) than female students (47.2%) [23]. In contrast, a previous study in Iran noted the opposite trend, where the awareness rate of male students was higher than that of female students (41% and 13.9%) [28].

However, most of the students were aware of toxoplasmosis in this study; their habits increase the risk of getting infected by toxoplasma gondii as they raise cats in their home (37.3%) and (36.6%) handle cats and change their litter boxes. The cats are considered the primary source of toxoplasma gondii because the infected cat can pass millions of oocysts, which require not less than 24 hours to mature and become infectious [29]. Also, in this study (36.6%) of students are at risk of getting toxoplasma gondii as they drink untreated tap water, which has been reported to play a role in toxoplasma gondii transmission [30]. The infective stage of the disease (oocyst) can resist freezing and moderately high-water temperatures and remain viable for a long time in water [31]. Furthermore, the study reveals that (6%) of students are at risk of toxoplasmosis as they do not wash the fruit and vegetables before eating them, which may be contaminated with the stool of the infected cat. Also (25.7%) of the participants eat semi-cocked meat. These findings are different from those of Senosy (2020) [22], which showed that (29,6%) eating improperly washed fruits and (24.8%) eating undercooked meat or poultry. A closer result was also recorded in Jordan, where (16.7%) eat raw meat [25].

This study reported that many appropriate behaviours and habits help the students in toxoplasmosis prevention as they do not have cats in their home (62.7%), do not eat unwashed vegetables and fruits (94%), and do consume unpasteurized milk (79.1%).

Study Limitations

The study targeted undergraduate students (medical and pharmacy students), who mostly have more knowledge than other students at the University of Tripoli.

Not all questions were answered by students; those were excluded from the results.

Conclusions and Recommendations

The current study demonstrated a high level of knowledge about toxoplasmosis among students at the University of Tripoli. However, most of the preventive measures used could be explained by cultural and religious habits in Tripoli. The negative attitude toward toxoplasmosis in this study generates a critical need for improving the educational system to raise awareness about hygienic measures, which are crucial to avoiding infection, knowing the risk factors, mechanism of transmission, symptoms, and preventive behaviour. The university student could be the first line to educate the risk group, especially women of childbearing age and immunocompromised people, in order to reduce the risk of vertical transmission and opportunistic infection.

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Conflict of Interest Statement

The authors declare no conflict of interest.

Authors' Contributions

The authors confirm their contributions to the paper as follows: study conception and design: Mohamed Elashal and Ahlam Ellafi; data collection: Mohamed Elashal; analysis and interpretation of results: Ahlam Ellafi; draft manuscript preparation: Mohamed Elashal, Mohamed Bashir Elagili, Ahlam Ellafi, and Safa Sharfudeen. Final review and editing Safa Sharfudeen.

All authors reviewed the results and approved the final version of the manuscript.

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