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Assessment of Toxoplasmosis-Related Knowledge Among Patients and Their Companions at the University Hospital of Maringá

Avaliação do conhecimento sobre Toxoplasmose Ocular de pacientes e acompanhantes do Hospital Universitário de Maringá

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ABSTRACT

Introduction: Toxoplasmosis is a widely distributed parasitic disease caused by the protozoan *Toxoplasma gondii*. It typically causes mild symptoms such as lymphadenopathy and fever in immunocompetent individuals, but can lead to more severe symptoms in immunocompromised patients and congenital infections. **Objective:** Assess the knowledge of patients and their companions regarding various aspects of Toxoplasmosis. **Methods:** This study was conducted at the Regional University Hospital of Maringá from July to September 2024. Questionnaires were administered to patients and their companions about the manifestations, modes of transmission, and prophylaxis of Toxoplasmosis. **Results:** A total of 30 men and 40 women were interviewed, predominantly aged between 25 and 59 years (64.2%), with at least a high school diploma (71.4%) and prior knowledge of Toxoplasmosis (87.1%). The most common sources of infection mentioned were contact with cat feces (81.4%), consumption of raw vegetables (55.7%), and undercooked meats (52.9%). The most frequently cited symptoms associated with Toxoplasmosis were problems during pregnancy (75.7%) and fever (72.9%). Itching (57.1%) and a burning sensation (41.4%) were the most reported among ocular symptoms. Only one patient reported having the disease, with involvement of the left eye. **Conclusion:** Most respondents understand the risks associated with Toxoplasmosis, but the presence of myths and inadequate practices shows that measures to analyze and spread knowledge about this disease could be effective for its prevention and control.

Keywords: Public Health; Toxoplasmosis, Ocular; Surveys and Questionnaires; Health Knowledge, Attitudes, Practice; Brazil; Disease Transmission, Infectious.

RESUMO

Introdução: A Toxoplasmose é uma doença parasitária amplamente distribuída, causada pelo protozoário *Toxoplasma gondii*. Geralmente, provoca sintomas leves, como linfadenopatia e febre em indivíduos imunocompetentes, mas pode levar a sintomas mais graves em pacientes imunocomprometidos e em infecções congênicas. **Objetivo:** Analisar o conhecimento de pacientes e seus acompanhantes sobre diversos aspectos da Toxoplasmose. **Métodos:** Este estudo descritivo e quantitativo foi realizado no Hospital Universitário Regional de Maringá, de julho a setembro de 2024. Questionários foram aplicados a pacientes e seus acompanhantes sobre as manifestações, modos de transmissão e profilaxia da Toxoplasmose. **Resultados:** Um total de 30 homens e 40 mulheres foram entrevistados, predominantemente com idades entre 25 e 59 anos (64.2%), com pelo menos ensino médio completo (71.4%) e conhecimento prévio sobre Toxoplasmose (87.1%). Os modos de infecção mais mencionados foram: contato com fezes de gato (81.4%), consumo de vegetais crus (55.7%) e carnes malcozidas (52.9%). Os sintomas mais frequentemente citados associados à Toxoplasmose foram problemas durante a gravidez (75.7%) e febre (72.9%). Entre os sintomas oculares, coceira (57.1%) e sensação de queimação (41.4%) foram os mais relatados. Apenas um paciente relatou ter a doença, com envolvimento do olho esquerdo. **Conclusão:** A maioria dos entrevistados entende os riscos oculares associados à Toxoplasmose, mas a presença de mitos e práticas inadequadas destaca a necessidade urgente de melhorar a educação em saúde para prevenir a doença.

Palavras-chave: Saúde Pública; Toxoplasmose Ocular; Pesquisas e Questionários; Conhecimentos, Atitudes e Práticas em Saúde; Brasil; Transmissão de Doenças Infecciosas.

INTRODUCTION

Toxoplasmosis is a global zoonosis caused by the apicomplexan protozoan *Toxoplasma gondii*, which affects about 30.0% of the global population. The etiological agent of this parasitosis completes its sexual reproduction

phase in the intestinal epithelium of domestic or wild felines, which are the known definitive hosts. During sexual reproduction, oocysts are formed and released in the feces of felines, which, after sporulation, become infectious through oral ingestion. Intermediate hosts include various

homeothermic animals such as sheep, birds, rodents, cattle, pigs, and humans. These hosts do not spread the disease through their feces and become infected through the ingestion of oocysts, tissue cysts, or congenitally¹⁻².

In intermediate hosts, asexual reproduction occurs, and sporozoites from ingested oocysts develop into tachyzoites, which are motile and can invade other tissues, or into bradyzoites, creating cysts that are difficult for the immune system to destroy. It is worth noting that tachyzoites cross the placental barrier, causing congenital Toxoplasmosis, and are also released in milk³⁻⁴.

The severity of infection during pregnancy depends, among other factors, on the trimester in which it occurs. In the first trimester, the most common manifestations in the fetus are deafness, hydrocephalus, intracranial calcifications, intellectual disability, and chorioretinitis, also, miscarriage may occur. In the third trimester, chorioretinitis and intellectual deficits may appear, with the other symptoms being less common and pronounced⁵⁻⁷.

In immunocompetent adults, Toxoplasmosis is, in most cases, asymptomatic. However, a small percentage of individuals can show an increase in cervical lymph nodes during the acute phase of the disease, accompanied by fever, headache, fatigue, and myalgia, among other symptoms. In immunocompromised patients, toxoplasmosis may result in more serious conditions, such as encephalitis or chorioretinitis. Consequently, the consequences of the disease are more harmful to this group, as well as to fetuses, affecting a large number of individuals⁸⁻⁹.

Many studies address the knowledge of Toxoplasmosis in specific populations¹⁰⁻¹², such as students or pregnant women. In this study, we focus on users of the public health system in our immediate region. We hypothesize that, since Toxoplasmosis often presents as an asymptomatic condition, the general population may have limited familiarity with its transmission routes, potential health consequences, and preventive measures.

This study seeks to assess patients' and companions' knowledge about toxoplasmosis, to identify misconceptions and gaps in understanding where targeted interventions could be beneficial. This could be used to mitigate the impacts of the disease, especially in vulnerable populations, ultimately contributing to the broader efforts of public health education and disease control. The interviewers also have informed participants about facts and practices related to the disease transmission, prevention, and manifestations after the answers were collected, targeting the gaps in knowledge identified in an attempt to inform the population while data were being collected.

METHODS

This report presents a descriptive, cross-sectional, and quantitative study conducted at the Regional University Hospital of Maringá, a public hospital located in the city of Maringá, in the northern region of Paraná, Brazil. The hospital serves an average of 93,000 patients annually and provides care to residents of more than 130 municipalities."

Data were collected through face-to-face interviews with patients and their companions between July and August 2024 using a paper questionnaire¹³ by the authors (CAAE: 45414621.7.0000.0104). The questionnaire was created by the authors for this study. Informed consent was obtained through a written form. Patients and companions in the general medicine ward were approached and asked if they were willing to participate in the study. Those who agreed were asked to answer the questionnaire. The first ten interviews served as a pilot

and were excluded from the data. The questionnaire consisted of 14 closed-ended multiple-choice questions divided into four sections: (1) *general information*, (2) *knowledge of the disease*, (3) *ocular manifestations*, and (4) *personal experience with toxoplasmosis*. The data was collected by the authors on the questionnaire paper and later coded via Google Forms©. Patients who were nearby and could overhear the conversation were not interviewed.

The *general information* section comprised six questions and collected data such as age, gender, chronic illnesses, education level, pregnancy status, and whether they had prior knowledge of Toxoplasmosis. If participants reported some knowledge about Toxoplasmosis, even when only recognizing the name *cat disease*, as it is commonly known in Brazil, they were asked further questions about the disease.

The *knowledge of the disease* section included four questions and covered potential manifestations of Toxoplasmosis, transmission routes, at-risk populations, and preventive measures.

The *ocular manifestations* section comprised two questions and inquired about the participants' knowledge of ophthalmological symptoms and care due to ocular Toxoplasmosis manifestations or due to other reasons.

The *personal experience with Toxoplasmosis*, with two questions, asked participants who reported having the disease to elaborate on their experiences.

RESULTS

Data analysis comprised coding and the calculation of descriptive statistics¹³. Percentages were calculated based on the total number of participants, unless stated otherwise, and regardless of whether they were familiar or not with the disease.

Participants were 30 men (42.9%) and 40 women (57.1%). None of the women was pregnant. Three participants were 18 to 25 years old (4.3%); 45 participants were 25 to 59 years old (64.2%), and 22 participants were 60 years old or older (31.4%). According to education, 20 people (28.6%) had completed elementary school; 35 completed high school (50.0%), 12 had an undergraduate degree (17.1%), and three had graduate degrees (4.3%). Nine respondents reported never having heard about toxoplasmosis (12.9%).

Participants identified several potential routes of infection, which included incorrect notions of how the disease is spread. The majority of people (81.4%) correctly associated contact with cat feces as a risk for Toxoplasmosis infection. A portion of respondents incorrectly believed that contact with dog feces (37.1%) and consumption of raw fish (30.0%) posed a risk of toxoplasmosis transmission. The consumption of raw fruits and vegetables (55.7%), raw milk or dairy products (47.1%), and undercooked or raw meats (52.9%) was also recognized as a possible way to contract Toxoplasmosis. Table 1 shows the number of reports per perceived source of transmission.

Table 1. Participants' Perceived Sources of Transmission.

Means of Transmission	N°	%
Contact with cat feces	57	81.4
Contact with dog feces	26	37.1
Consumption of raw fruits and vegetables	39	55.7
Consumption of raw or undercooked meats	37	52.8
Consumption of raw milk or dairy products	32	45.7
Consumption of raw fish	21	30.0

Regarding Toxoplasmosis symptoms recognized by the participants; the most commonly referred to problems during pregnancy (75.7%)

and fever (72.9%). Blurred vision was also identified by a significant number of participants as a possible manifestation of the disease (64.3%). Other symptoms associated with Toxoplasmosis included blindness (57.1%), intellectual disability (37.1%), abortion (54.3%), and learning disorders (48.6%). In general, less severe symptoms were associated more frequently than more serious ones. Table 2 presents symptoms known to participants by some reports and relative percentages.

Table 2. Symptoms Associated with Toxoplasmosis.

Symptoms	N°	%
Pregnancy problems	53	75.7
Fever	51	72.9
Blurred vision	45	64.3
Blindness	40	57.1
Abortion	38	54.3
Learning disorders	34	48.6
Intellectual disability	26	37.1

Regarding the perceived contamination risk of specific populations, participants reported believing that it included fetuses (77.1%), pregnant women (84.3%), children (82.9%), and adults and the elderly (84.3%) were all considered possible groups at risk. Table 3 presents the population at risk of infection identified by the participants.

Table 3. Participants' Reports on Perceived Risk Population.

Who can be infected	N°	%
Fetuses	54	77.1
Pregnant women	59	84.3
Children	58	82.9
Adults and the elderly	59	84.3

Regarding prophylaxis (Table 4), there was a good level of awareness about practices such as washing raw vegetables (75.7%), consuming well-cooked meat (65.7%), drinking filtered water (74.3%), washing hands after handling raw meat (74.3%), and washing hands after manipulating dirt (81.4%). However, a significant portion of participants also held inaccurate notions about preventive measures. For instance, 72.9% mistakenly believed that avoiding contact with pigeon, rat, and cockroach feces was a valid prophylactic method, as well as avoiding contact with dog feces (44.3%). Part of the individuals correctly believed that wearing a mask while changing a cat's litter box (51.4%) was necessary. Furthermore, not allowing children to play in dirt or sand (40.0%) and giving away domestic cats during pregnancy (31.4%) were mistakenly associated as effective prevention strategies.

Table 4. Reported Prophylactic Measures Associated with Toxoplasmosis.

Preventive Measures	N°	%
Washing raw vegetables	53	75.7
Consuming well-cooked meat	46	65.7
Drinking filtered water	52	74.3
Washing hands after handling raw meat	52	74.3
Washing hands after handling dirt	57	81.4
Avoiding contact with pigeon, rat, and cockroach feces	51	72.9
Avoiding contact with dog feces	31	44.3
Wearing a mask while changing a cat's litter box	36	51.4
Not allowing children to play in dirt or sand	28	40.0
Giving away domestic cats during pregnancy	22	31.4

We also asked if any participants had experienced common symptoms associated with the ocular manifestation of Toxoplasmosis at any point in their lives. Among them, 57.1% mentioned having

experienced itchiness, and 28.6% reported having seen "clouds" or "floaters" when looking at bright lights, 31.4% experienced red eyes, and 41.4% a burning sensation in their eyes. Approximately one-third of participants (30.0%) had not experienced any of these symptoms. Table 5 shows the percentage of participants who reported experiencing symptoms associated with Toxoplasmosis.

Table 5. Symptoms Experienced by Participants.

Eye symptoms	N°	%
Itchy eyes	42	60.0
Burning eyes	29	41.4
Red eye	22	31.4
Seeing 'clouds' or 'floaters' when looking at bright light	20	28.5

Results regarding initiatives to seek treatment and care, 27 out of the 49 participants who experienced at least one symptom (55.1%) had gone to an ophthalmologist because of them, while 60% of all participants (N=42) visited an ophthalmologist for other reasons.

Only one of the participants in the study was diagnosed with Toxoplasmosis, which was not acquired congenitally and affected only one eye.

DISCUSSION

The results obtained in this study partially confirm our hypothesis that patients and their companions in our target population have incorrect knowledge about Toxoplasmosis, as incorrect means of transmission (contact with dog feces and consumption of raw fish) and prevention (avoiding contact with dog, pidgeon, rat and cockroach feces, not allowing children to play in dirt or sand, and giving away domestic cats during pregnancy) were still associated.

Further studies could explore associations between these findings and participants' educational levels using data collected in this survey. This might be relevant as a portion of the Brazilian population is still faced with conditions of illiteracy or functional illiteracy¹⁴ and could be better targeted by awareness-raising campaigns if such data were to be analyzed.

Despite the prevalence of the disease being estimated at around 25.7% globally¹⁵, only one subject out of the 70 interviewed reported having Toxoplasmosis, in a non-congenital form. Even though it cannot be said that the individuals who had experienced some of the ocular symptoms associated with Toxoplasmosis had contracted the parasite, it is safe to say that more than one of the 70 interviewees has certainly contracted the disease at some point, probably asymptotically. The degree of underreporting of the parasitosis in the target group is probably high, based on the aforementioned analysis.

The South American continent has the third highest rate of Toxoplasmosis in the world⁸, and the population of *T. gondii* in Brazil is highly diverse, with a few successful clonal lineages that have expanded into wide geographical areas, in contrast to North America and Europe, where the Type II clonal lineage is overwhelmingly predominant. In South America, ocular involvement in congenital Toxoplasmosis is more frequent than in other locations around the world¹⁶.

As such, knowledge about these manifestations of the disease can be important for its identification. The majority of participants in the study expressed an understanding of the symptomatic possibilities such as blurred vision and blindness associated with *T. gondii* infection, as well as having gone to an ophthalmologist, whether due to discomfort related to manifestations that could be related to Toxoplasmosis (55.1% of those who experienced these symptoms) or not (60.0%). This is a measure that contributes to the identification of

at least the ocular disorders relative to Toxoplasmosis¹⁷⁻¹⁸. Knowledge about these manifestations also directly affects the quality of life of patients with the disease¹⁹.

One point of notice in the data collected is the relatively higher number of associations to milder symptoms, such as pregnancy problems, fever, and blurred vision, to the detriment of more severe ones, such as blindness, abortion, learning disorders, and intellectual disability. The smaller percentage of people associating these manifestations in comparison to the others provides an overview on the lack of knowledge surrounding the clinical manifestations of Toxoplasmosis, which especially affects newborns who acquired it congenitally²⁰, such as hydrocephalus, microcephaly, intracranial calcifications, chorioretinitis, strabismus, blindness, epilepsy, mental and motor deficiency, petechiae associated with thrombocytopenia and anemia²¹⁻²³.

This information can be further supported by the fact that, although the accuracy rates for this section of the questionnaire were satisfactory, there was a noticeable reduction in the number of respondents who said that children (82.9%), pregnant women and older adults (84.3%) were at risk groups compared to fetuses (77.1%). Moreover, a smaller portion of the population might believe that fetuses are one of the groups at risk, perhaps due to non-pathognomonic conditions, which can overshadow the congenital form of the disease, since they are currently linked in the country to viruses such as Zika and Chikungunya, despite the regional prevalence of 5-23 infected children for every 10,000 births of Toxoplasmosis¹⁶.

More in-depth statistical analysis can be performed after collecting supplementary data to establish or dismiss possible relations between knowledge about Toxoplasmosis and socioeconomic factors such as level of education and field of the interviewees' work, possibly with a larger sample size. Assessing patients in different healthcare settings could also provide a better understanding of the general population, as the interviews were conducted in only one hospital. Data such as health issues that could be associated with the disease, participants' access to health care, where they live in the city or rural areas, and maybe even their income could be analyzed to give a better picture of the sample. Additionally, further depiction of disparities between different genders, as well as comparing non-pregnant to pregnant women, could be considered. Assessing the participants' application of their knowledge before and after the orientations given (after the execution of the survey) is also one of this study's goals. Evaluating participants' application of knowledge before and after the informational sessions provided following the survey is also a goal envisioned for future phases of this study."

CONCLUSION

This study investigated the perceptions and knowledge of patients and their companions about the Toxoplasmosis disease. Most participants (over 50.0%) were aware of the main symptoms of Toxoplasmosis, and were also able to correctly associate some means of infection, prophylactic measures, and individuals at risk. However, the results have pointed out the persistence of myths such as the idea that the disease can be transmitted by dogs' feces, and the use of inadequate practices. This shows that measures to analyze and spread knowledge about this disease could be effective for its prevention and control by disproving misconceptions that were identified, as well as supplementing the public's knowledge, filling gaps that were detected with valid and more robust information. In countries where Toxoplasmosis is prevalent, such as Brazil, findings like these could

be used to better target misconceptions and address gaps in public awareness."

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