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# Knowledge of primary healthcare professionals about gestational toxoplasmosis

## *Conhecimento de profissionais da atenção primária à saúde sobre toxoplasmose gestacional*

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## ABSTRACT

**Introduction:** Toxoplasmosis is considered a public health problem because it occurs worldwide and causes complications in immunocompromised individuals and potentially serious consequences with congenital transmission. **Objective:** to analyze the knowledge of primary healthcare professionals in relation to gestational toxoplasmosis. **Methods:** This is a cross-sectional study. Data were analyzed using descriptive statistics estimating the prevalence ratio and respective 95% confidence intervals to identify the presence of associated factors. **Results:** Most primary healthcare professionals have no access to information about toxoplasmosis, have never participated in training, and few provide individual or collective guidance to pregnant women on this subject. Just over half are aware of the need to notify the disease, and a minority know all the transmission routes, diagnostic tests and preventive measures. **Conclusions:** this survey suggests that professionals lack knowledge about toxoplasmosis and highlights a need for continuing training and discussions, so that the planning of strategies for the prevention and control of gestational toxoplasmosis are constantly improved.

**Keywords:** Toxoplasma; Education, Continuing; Primary Prevention; Secondary Prevention.

## RESUMO

**Introdução:** A toxoplasmose é considerada problema de saúde pública por ter distribuição mundial e por ocasionar complicações a indivíduos imunodeprimidos e danos potencialmente graves quando há transmissão congênita. **Objetivo:** analisar o conhecimento dos profissionais de saúde da Atenção Primária em relação à toxoplasmose gestacional. **Métodos:** trata-se de um estudo transversal. Os dados foram analisados por meio de técnicas de estatística descritiva, foi estimada a razão de prevalência e seus respectivos intervalos de confiança (95%) para testar a presença de fatores associados. **Resultados:** a maioria não tem acesso às informações sobre a doença, nunca participou de capacitações, raramente faz orientações individuais ou coletivas para as gestantes sobre o tema; pouco mais da metade têm conhecimento da necessidade de notificar a doença; minoria conhece todas as vias de transmissão, exames diagnósticos e medidas preventivas. **Conclusões:** a pesquisa sugere que há deficiência no conhecimento dos profissionais, ressaltando a necessidade de capacitações e discussões permanentes, para que o planejamento de estratégias de educação em saúde e controle da toxoplasmose gestacional seja aprimorado continuamente.

**Palavras-chave:** Toxoplasma gondii; Educação permanente; Prevenção primária; Prevenção secundária.

## INTRODUCTION

Toxoplasmosis is considered a public health problem because it occurs worldwide and can cause complications in immunocompromised individuals as well as in the fetuses or children of mothers who became infected during pregnancy.[1] Approximately five out of every 1000 non-immune pregnant women acquire the infection, with a high probability of transmission to the fetus.[2] Most of infected children do not have clinical signs at birth, but later show signs of the disease, mainly related to ocular, motor and central nervous systems.[3] The parasite causes high morbidity and economic losses, however little information is available to quantify its impact on the public health.[4]

The situation of gestational and congenital toxoplasmosis in Brazil continues to be a concern, as the surveillance and control program is still in a development phase and, despite the existence of manuals from the Ministry of Health with recommendations, divergences exist in the conduct between states and municipalities.[5] To reduce the negative impact of this scenario, primary healthcare professionals (PHP) must be qualified to control the disease, as basic healthcare units (BHU) are considered the best setting to provide prenatal care and assistance to pregnant women. Therefore, primary preventive measures, such as guidelines, and secondary prevention measures with screening and exams to detect changes and diseases, such as gestational toxoplasmosis, must be offered in this setting.[5] Early diagnosis is essential for the initiation of drug therapy in pregnant women as there is evidence that treatment reduces maternal-fetal transmission and the severity of sequelae.[6]

The interpretation of gestational toxoplasmosis screening tests is complex. Moreover, trained professionals are required for the appropriate management of confirmed or suspected cases, and to provide specific guidance to susceptible pregnant women during prenatal care.[7] However, few studies have been published that evaluate the knowledge of health professionals on gestational toxoplasmosis with some literature highlighting the dearth of knowledge regarding prevention, diagnosis and treatment of pregnant women.[8] In view of the above, this study aimed to analyze the knowledge of PHP in relation to gestational toxoplasmosis and the guidelines for its control, as well as investigate factors linked to gaining knowledge regarding this topic.

## METHODS

This cross-sectional study was carried out between January 2020 and December 2021 in a city of the northwestern region of São Paulo State with 480,439 inhabitants.[9] The primary healthcare structure of the municipality is composed of 29 BHU, 19 of which are family health centers and eight are traditional BHU. These primary treatment centers employ 73 registered nurses, 187 nursing technicians/assistant nurses and 35 gynecologists/obstetricians. Due to the COVID-19 pandemic which began in March 2020, only 22 BHU participated in this study as the municipal healthcare network was reorganized with the other BHU becoming respiratory symptom care reference services and inaccessible.

For data collection, interviews were carried out with nurses, nursing technicians/assistants and doctors who worked in the BHU of the city during the data collection period. The survey used a structured questionnaire comprised multiple-choice and two open questions, constructed specifically for the study based on the literature on this topic.[10,11]

The questionnaire consisted of 27 questions, which were grouped into the following sections:

I - Characterization of the study population (sex; age; professional category; type of employment contract; time working with pregnant women in the primary healthcare network; access to information on gestational/congenital toxoplasmosis; last refresher/training course on gestational/congenital toxoplasmosis; frequency of providing guidance to pregnant women about gestational toxoplasmosis);

II - Characterization of the BHU and actions offered to control gestational/congenital toxoplasmosis (professionals prepared to diagnose/suspect gestational toxoplasmosis; turnover of human resources; a pregnant women support group that addresses the topic of gestational/congenital toxoplasmosis; runs campaigns on gestational/congenital toxoplasmosis; professionals provide a reference guide when the pregnant woman is referred to another health service);

III - Knowledge about gestational/congenital toxoplasmosis and guidelines for its control (the city has a protocol for prenatal care, including guidelines on gestational toxoplasmosis; need to refer the pregnant woman to another health service in case of suspicion or diagnosis of toxoplasmosis; service that pregnant women should be referred to in case of suspicion or diagnosis of toxoplasmosis; places for monitoring pregnant women with suspected or diagnosed acute gestational toxoplasmosis; toxoplasmosis is a mandatory notifiable disease; tests used to diagnose gestational toxoplasmosis; test performed on seroconverted pregnant women to diagnose congenital toxoplasmosis;

IV - Medical conduct regarding the results of serology for toxoplasmosis in pregnant women (four questions exclusively for gynecologists/obstetricians in respect to the serology results – medical conduct when: IgM and IgG reactive; IgM and IgG non-reactive; IgM reactive and IgG non-reactive; IgM non-reactive and IgG reactive).

The interview was carried out individually at the BHU where the professional was working, in a private room after the interviewee had read and signed an informed consent form.

The data were double inputted into an Excel spreadsheet and transferred to the Statistica software (version 13.5.0.17) of TIBCO Software Inc. Initially, the data were analyzed using descriptive statistics (frequency distribution - absolute and relative - and measures of central tendency and variability - mean and standard deviation).

Subsequently, scores were assigned to the variables of section III of the study:

a) For the variable "main toxoplasmosis-transmission routes", a maximum score of 3 was assigned if the response was complete (oral, transplacental and parenteral);

b) For the variable "tests used to diagnose gestational toxoplasmosis", the maximum score of 2 was achieved if the response included both serology and avidity;

c) For "guidelines that should be provided to pregnant women to prevent toxoplasmosis", the maximum score was 7 as this was the number of correct answers to be marked for this question.

d) The other variables in this section received a score of 1.

In this way, the sum of the scores (total score) of each professional in relation to knowledge about gestational toxoplasmosis and guidelines for its control could reach 19.

After obtaining individual knowledge scores, two groups were formed: a group of professionals with greater knowledge who obtained a total score higher than or equal to 12 about gestational toxoplasmosis and guidelines for its control and a group of professionals which comprised those with a total score less than or equal to 11. After forming these groups, the prevalence ratios and their respective confidence intervals (95%) were estimated to identify the presence of associated factors (variables of sections I and II of the study) of the group with the greatest knowledge about gestational toxoplasmosis and guidelines for its control.

The research project was approved by the Research Ethics Committee of the Medical School of São José do Rio Preto (FAMERP, CAAE 13376919.4.0000.5415).

## RESULTS

During the data collection period, 295 professionals were working in the BHU of the city however 16 refused to participate in the research, 14 were on vacation, seven were on medical leave, three were on leave, two were on maternity leave and 68 had been allocated to respiratory units. Therefore, 185 professionals were enrolled in the study.

Table 1 characterizes the healthcare professionals enrolled in the present study. Most professionals (105; 56.8%) reported that they almost never or never had access to information about gestational and congenital toxoplasmosis and the majority (166; 89.7%) have never participated in refresher or training courses on the topic. More than half of the professionals (96; 51.5%) never or almost never provided guidance to pregnant women about gestational toxoplasmosis (Table 1).

**Table 1:** Characterization of healthcare professionals (São José do Rio Preto, SP, 2021)

| Variable | | n (%) |
|---|---|---|
| Sex | Female | 169 (91.4) |
| | Male | 16 (8.6) |
| Age - years | Mean ± SD | 42.2±10.3 |
| | Minimum | 24 |
| | Maximum | 70 |
| Professional category | Tech/ass. nurse | 113 (61.1) |
| | Nurse | 47 (25.4) |
| | Physician | 25 (13.5) |
| Type of employment contract | Outsourced | 109 (58.9) |
| | Statutory | 76 (41.1) |
| Time working in that role in the basic network - years | Mean ± SD | 9.8±8.5 |
| | Minimum | 0.1 |
| | Maximum | 37 |
| Frequency of access to information on gestational and congenital toxoplasmosis | Never | 40 (21.6) |
| | Almost never | 65 (35.1) |
| | Sometimes | 48 (25.9) |
| | Almost always | 14 (7.6) |
| | Always | 18 (9.7) |
| Last training on gestational and congenital toxoplasmosis | Never | 166 (89.7) |
| | 1-4 years | 11 (5.9) |
| | 5 years or more | 8 (4.3) |
| Frequency of providing guidance to pregnant women about gestational toxoplasmosis | Never | 72 (38.5) |
| | Almost never | 24 (13.0) |
| | Sometimes | 34 (18.4) |
| | Almost always | 13 (7.0) |
| | Always | 42 (22.7) |

SD: Standard deviation

Tech/ass. nurse: Nursing technician or assistant nurse

Table 2 characterizes the BHU and measures offered to control gestational and congenital toxoplasmosis. Data on knowledge about the disease and guidelines for its control are presented in Table 3, highlighting the partial knowledge of professionals in relation to transmission routes, diagnostic tests and preventive measures.

**Table 2:** Characterization of Basic Health Units and actions offered to control gestational and congenital toxoplasmosis (São José do Rio Preto, SP, 2021)

| Variable | | n (%) |
|---|---|---|
| Professionals prepared to diagnose/suspect gestational toxoplasmosis | Yes | 100 (54.1) |
| | No | 54 (29.2) |
| | Do not know | 31 (16.8) |
| Human resources turnover | Never | 13 (7.0) |
| | Almost never | 74 (40.0) |
| | Sometimes | 65 (35.1) |
| | Almost always | 13 (7.0) |
| | Always | 10 (5.4) |
| | Do not know | 10 (5.4) |
| Group of pregnant women that discusses the topic of gestational and congenital toxoplasmosis | Yes | 31 (16.8) |
| | No | 102 (55.1) |
| | Do not know | 52 (28.1) |
| Campaigns on gestational and congenital toxoplasmosis | Never | 107 (57.8) |
| | Almost never | 10 (5.4) |
| | Sometimes | 30 (16.2) |
| | Almost always/always | 9 (4.9) |
| | Do not know | 29 (15.7) |
| Professionals provide a reference guide when the pregnant woman is referred to another health service | Never/almost never | 5 (2.7) |
| | Sometimes | 12 (6.5) |
| | Almost always | 22 (11.9) |
| | Always | 95 (51.4) |
| | Do not know | 51 (27.6) |

**Table 3:** Knowledge about gestational toxoplasmosis and guidelines for its control (São José do Rio Preto, SP, 2021)

| Variable | | n (%) |
|---|---|---|
| Existence of a municipal protocol for prenatal care, including guidance on gestational toxoplasmosis | Yes (correct) | 142 (76.8) |
| | No/do not know | 43 (23.2) |
| Referral of pregnant women to another health service in case of suspicion or diagnosis of toxoplasmosis | Yes (correct) | 127 (68.6) |
| | No/do not know | 58 (31.4) |
| Service that pregnant women should be referred to in case of suspicion/diagnosis of toxoplasmosis | Hospital de Base Outpatient Clinic (correct) | 95 (51.4) |
| | Other answers | 90 (48.6) |
| Locations for monitoring pregnant women suspected or diagnosed with acute gestational toxoplasmosis | Basic Health Unit and high-risk reference service (correct) | 121 (65.4) |
| | Other answers | 64 (34.6) |
| Is toxoplasmosis a notifiable disease? | Yes (correct) | 101 (54.6) |
| | No/do not know | 84 (45.4) |
| Period in which pregnant women can acquire toxoplasmosis | In all gestational trimesters (correct) | 142 (76.8) |
| | Other answers/do not know | 43 (23.2) |
| Main toxoplasmosis transmission routes* | Oral/transplacental/ parenteral (correct) | 21 (11.4) |
| | Only one or two of the correct answers above | 152 (82.2) |
| | Sexual/do not know | 12 (6.5) |
| Tests used to diagnose gestational toxoplasmosis* | Serology/avidity (correct) | 13 (7.0) |
| | Serology (Partially correct) | 90 (48.6) |
| | Do not know | 82 (44.3) |
| Test used to diagnose congenital toxoplasmosis | amniotic fluid PCR (correct) | 7 (3.8) |
| | Do not know/other exams | 178 (96.2) |
| Guidelines that should be given to pregnant women to prevent toxoplasmosis* | Wash your hands after handling soil or sand (correct) | 158 (85.4) |
| | Eat well-cooked meat (correct) | 154 (83.2) |
| | Drink treated and boiled water (correct) | 151 (81.6) |
| | Wash hands and preparation surfaces after handling raw meats (correct) | 147 (79.5) |
| | Do not feed cats raw or undercooked meat (correct) | 89 (48.1) |
| | Eat fresh, well-cooked sausages (correct) | 89 (48.1) |
| | Avoid drinking unpasteurized milk (correct) | 59 (31.9) |
| | Avoid contact with dog feces (incorrect) | 77 (41.6) |
| | Do not have contact with pigeon, rat and cockroach feces (incorrect) | 63 (34.1) |
| | Avoid contact with pigeons (incorrect) | 55 (29.7) |

* Questions had more than one correct answer

Regarding the conduct adopted by doctors according to the results of serology for toxoplasmosis in pregnant women, professionals demonstrated less knowledge regarding IgM reactive/IgG non-reactive and IgM non-reactive/IgG reactive results (Table 4).

Associations were identified in respect to greater knowledge about gestational toxoplasmosis and guidelines for its control in:

- professionals aged 31 to 40 years compared to those aged 51 to 60;
- doctors and nurses compared to nursing technicians/assistant nurses;
- professionals who always had access to information on the topic compared to those who never had access; and
- professionals who sometimes/almost always/always provide guidance to pregnant women about gestational toxoplasmosis compared to those who never provide information (Table 5).

**Table 4:** Conduct of doctors regarding toxoplasmosis serology results in pregnant women (São José do Rio Preto, SP, 2021)

| Variables | | n (%) |
|---|---|---|
| Reactive IgM and IgG | Refer to high-risk prenatal care and start treatment immediately with spiramycin (correct) | 19 (76.0) |
| | Other answers (incorrect) | 6 (24.0) |
| Non-reactive IgM and IgG | Advise pregnant women on prophylactic measures against infection and request serology bimonthly (correct) | 25 (100.0) |
| | Other answers (incorrect) | - |
| Reactive IgM and non-reactive IgG | Start drug treatment and perform the exam again (correct) | 11 (44.0) |
| | Other answers (incorrect) | 14 (56.0) |
| Non-reactive IgM and reactive IgG | Pregnant woman with an old disease or chronic toxoplasmosis. Only immunocompromised pregnant women require follow-up with an infectious disease specialist (correct) | 9 (36.0) |
| | Other answers (incorrect) | 16 (64.0) |

**Table 5:** Prevalence ratio of factors associated with greater knowledge about gestational toxoplasmosis and guidelines for its control (São José do Rio Preto, 2021)

| Variable | | Knowledge | | Prevalence ratio (95% confidence interval) |
|---|---|---|---|---|
| | | Less n (%) | More n (%) | |
| Sex | Female | 112 (90.3) | 57 (93.4) | 1 |
| | Male | 12 (9.7) | 4 (6.6) | 0.74 (0.31-1.78) |
| Age - years | 24-30 | 13 (10.5) | 8 (13.1) | 1.95 (0.85-4.46) |
| | 31-40 | 44 (35.5) | 34 (55.7) | 2.23 (1.14-4.37) |
| | 41-50 | 28 (22.6) | 8 (13.1) | 1.14 (0.48-2.72) |
| | 51-60 | 33 (26.6) | 8 (13.1) | 1 |
| | 61-70 | 6 (4.8) | 3 (4.9) | 1.71 (0.56-5.20) |
| Professional category | Tech/ass. nurse | 95 (76.6) | 18 (29.5) | 1 |
| | Nurse | 24 (19.4) | 23 (37.7) | 3.07 (1.84-5.14) |
| | Physician | 5 (4.0) | 20 (32.8) | 5.02 (3.15-8.01) |
| Type of employment contract | Outsourced | 77 (62.1) | 32 (52.5) | 1 |
| | Statutory | 47 (37.9) | 29 (47.5) | 1.30 (0.86-1.96) |
| Working time in the role in the basic network - years | 0.1-2 | 24 (19.4) | 13 (21.3) | 0.98 (0.49-1.93) |
| | 3-6 | 26 (21.0) | 14 (23.0) | 0.97 (0.50-1.90) |
| | 7-10 | 32 (25.8) | 14 (23.0) | 0.85 (0.43-1.67) |
| | 11-20 | 26 (21.0) | 11 (18.0) | 0.83 (0.40-1.70) |
| | 21-37 | 16 (12.9) | 9 (14.8) | 1 |
| Frequency of access to information on gestational and congenital toxoplasmosis | Never | 31 (25.0) | 9 (14.8) | 1 |
| | Almost never | 44 (35.5) | 21 (34.4) | 1.44 (0.73-2.82) |
| | Sometimes | 31 (25.0) | 17 (27.9) | 1.57 (0.79-3.14) |
| | Almost always | 10 (8.1) | 4 (6.6) | 1.27 (0.46-3.48) |
| | Always | 8 (6.5) | 10 (16.4) | 2.47 (1.22-5.01) |
| Last training on gestational and congenital toxoplasmosis | Never had | 109 (87.9) | 57 (93.4) | 1 |
| | 1-4 years | 8 (6.5) | 3 (4.9) | 0.79 (0.30-2.13) |
| | 5 years or more | 7 (5.7) | 1 (1.6) | 0.36 (0.06-2.30) |
| Frequency of providing guidance to pregnant women about gestational toxoplasmosis | Never | 67 (54.0) | 5 (8.2) | 1 |
| | Almost never | 19 (15.3) | 5 (8.2) | 3.00 (0.95-9.48) |
| | Sometimes | 21 (16.9) | 13 (21.3) | 5.51 (2.14-14.20) |
| | Almost always | 6 (4.8) | 7 (11.5) | **7.75 (2.90-20.74)** |
| | Always | 11 (8.9) | 31 (50.8) | **10.63 (4.48-25.23)** |
| Preparation of professionals to diagnose/ suspect gestational toxoplasmosis | Yes | 64 (51.6) | 36 (59.0) | 0.93 (0.61-1.42) |
| | No | 33 (26.6) | 21 (34.4) | 1 |
| | Do not know | 27 (21.8) | 4 (6.6) | |
| Human resources turnover | Never | 10 (8.1) | 3 (4.9) | 0.58 (0.17-2.01) |
| | Almost never | 49 (39.5) | 25 (41.0) | 0.85 (0.37-1.92) |
| | Sometimes | 44 (35.5) | 21 (34.4) | 0.81 (0.35-1.86) |
| | Almost always | 9 (7.3) | 4 (6.6) | 0.77 (0.25-2.34) |
| | Always | 6 (4.8) | 4 (6.6) | 1 |
| | Do not know | 6 (4.8) | 4 (6.6) | |
| Group of pregnant women, including the topic of gestational and congenital toxoplasmosis | Yes | 15 (12.1) | 16 (26.2) | 1.55 (1.00-2.40) |
| | No | 68 (54.8) | 34 (55.7) | 1 |
| | Do not know | 41 (33.1) | 11 (18.0) | |
| Campaigns on gestational and congenital toxoplasmosis | Never | 69 (55.7) | 38 (62.3) | 1 |
| | Almost never | 5 (4.0) | 5 (8.2) | 1.41 (0.72-2.75) |
| | Sometimes | 23 (18.6) | 7 (11.5) | 0.66 (0.33-1.32) |
| | Almost always / always | 7 (5.7) | 2 (3.3) | 0.63 (0.18-2.18) |
| | Do not know | 20 (16.1) | 9 (14.8) | |
| Provision of a reference guide when the pregnant woman is referred to another health service | Never /almost never | 3 (2.4) | 2 (3.3) | 1 |
| | Sometimes | 7 (5.7) | 5 (8.2) | 1.04 (0.29-3.69) |
| | Almost always | 15 (12.1) | 7 (11.5) | 0.80 (0.23-2.74) |
| | Always | 58 (46.8) | 37 (60.7) | 0.97 (0.32-2.93) |
| | Do not know | 41 (33.1) | 10 (16.4) | |

Tech/ass. Nurse: nursing technician or assistant nurse

## DISCUSSION

The majority of research participants had worked for an average of 9.8 years in the BHU of the city, a fact that contributes to the fulfillment of longitudinal care and the formation of bonds with users.[12] Professionals have little access to information about toxoplasmosis and there is currently little discussion about the disease in the media. Despite the existence of continuous education in the city of this study, the topic had not yet been addressed during the training of the majority of professionals, which may affect their level of knowledge and adequate control and management of the problem.

Professionals reported that health education activities, such as guidelines, groups and campaigns aimed at preventing the disease in pregnant women, were infrequent. A similar fact occurred in studies carried out in Paraná and Uberlândia, both in Brazil, as few pregnant women reported that they had received guidance or information on preventive measures against toxoplasmosis from BHU and reference hospital professionals. This situation may be related to work overload and the lack of knowledge of professionals so that educational strategies were not carried out.[10,13,14]

Professionals believe that the team is prepared to suspect and diagnose gestational toxoplasmosis, however the scenario infers limitations in the continuing education of professionals. Training must be based on the needs of the health service and studies of local determinants in each region, which consequently contribute to changes in health practices, transforming the work process through critical and reflective actions.[15]

The city in question has little turnover of professionals, as stated by the research participants, so that the operationalization of educational groups and campaigns would favor the relationship between the health team and the population by elucidating diseases, and exchanging knowledge and experiences about self-care between pregnant women.[16] A repetitive transfer of information through visual and personal contact is necessary to ensure the effectiveness of health education activities.[17] A study carried out in BHU in Niterói, Rio de Janeiro State showed that pregnant women who participated in educational activities improved preventive measures, such as the taking care when the women come into contact with soil and drinking filtered water.[18]

In the city of this study, the main communication tools in the care networks were referral and counter-referral forms, and the pregnant woman's health record card. According to this study, professionals believed that this referral form was frequently filled out with information and clinical data of the pregnant woman for the continuation of prenatal care. In a study carried out with PHP in the city of Rio de Janeiro, it was found that the most frequent type of formal communication between points of care also occurred through referral and counter-referral forms; case discussions, technical meetings with specialists, teleconferencing, telehealth, electronic medical records and electronic communication were infrequent.[19]

The majority of the professionals interviewed are aware of the existence of the municipal prenatal care protocol and that pregnant women suspected or diagnosed with toxoplasmosis should be referred to the high-risk reference center. They also know that the follow-up should occur simultaneously at both levels of healthcare with communication between the two to share the therapeutic strategy as an interdisciplinary team, aiming to guide the practice

with the prospect of offering extended, comprehensive and resolute assistance.[20]

In the present study, professionals reported knowledge about the mandatory reporting of suspected and confirmed cases of gestational toxoplasmosis however a significant number did not know. This fact may be related to problems in the interaction between BHU and health surveillance teams, which can result in little involvement of PHP in the process of notification and investigation of suspected cases, causing difficulties in the effective control of diseases and complications.[21]

In the case of gestational toxoplasmosis, lack of notification prevents the identification of outbreaks, the rapid blocking of the source of transmission and taking prevention and control measures in a timely manner, in addition to preventing adequate therapeutic interventions to reduce complications, sequelae and death.[22] It was observed in this study that the majority of professionals are aware that pregnant women can acquire toxoplasmosis in any gestational trimester, a result similar to the research carried out with healthcare professionals from BHU in the city of Maringá.[10]

Regarding the transmission routes of toxoplasmosis, a significant number of professionals knew the oral, which is consistent with the reality since parenteral transmission (blood transfusion and organ transplantation) is rare.[22] Only half the doctors and nurses mentioned transplacental transmission in one study.[18]

Another worrying issue identified in the present study is related to the fact that most professionals only know the serological investigation of acute (IgM) and chronic (IgG) phase antibodies. However, as a high avidity may define the phase of infection as chronic, and in the presence of low avidity, the doctor can take measures for a possible acute infection. In addition to polymerase chain reaction (PCR) of amniotic fluid to diagnose fetal toxoplasmosis from the 18th week of pregnancy, little was mentioned by professionals.[23] A similar result was reported in a study carried out in Morocco with professionals working in public health centers, in which the majority knew the IgG and IgM serological tests, but only 14.5% knew about the avidity test and 39.5% knew about PCR for diagnosing congenital toxoplasmosis.[24]

In two studies carried out with North American obstetricians and gynecologists, most were not aware of the avidity test.[25] In addition, in national studies, health professionals from public services had difficulty interpreting test data and recognizing the importance of the test in the first trimester of pregnancy.[18] A study carried out in Niterói, Rio de Janeiro State with PHP revealed knowledge of preventive measures such as washing hands before handling food and after handling soil or cat litter boxes. Other prevention measures were mentioned infrequently and there were some misconceptions related to the mode of transmission.[18]

In Juíz de Fora, Minas Gerais State, a survey showed that only 7.4% of professionals recognized the cat as the animal that eliminates the parasite through feces, and mistakenly mentioned that dogs (51.7%) and pigeons (21.6%) also eliminate oocysts in the feces. In addition, they are unaware of the preventive measure for non-immune pregnant women of not eating raw vegetables.[26,27] A similar result was found in an international study carried out in Nigerian hospitals, in which doctors listed transmission through cat feces and consumption of contaminated meat, but less than a third knew that water is a transmission vehicle. More than one third of Nigerian doctors incorrectly stated that humans could eliminate the parasite through feces.[28] In the United States, obstetrician-gynecologists have little understanding of the risk factors of transmission through exposure to domestic cats, gardening, food, water and soil.[26]

In the present study, it was observed that health professionals have mistaken or incomplete knowledge about preventive measures against toxoplasmosis, demonstrating a lack of knowledge of the evolutionary forms of the parasite. Regarding conduct in respect to serology results, the majority of doctors correctly responded that in the face of positive IgM and negative IgG serology they would start drug treatment and repeat the test. Nevertheless, a good number responded that they would only repeat the test, even though early treatment is essential to avoid fetal contamination; this result may be a very recent infection or false positive.[29] It is worth noting that IgM class antibody titers increase rapidly soon after infection in the acute phase and after a few months, they begin to decline, and may persist for a year or more in circulation, which may cause false-positive results for chronic infections.[30]

When dealing with negative IgM and positive IgG serology, most responded that they would not adopt any action, as the result indicates chronic infection, however, attention is needed in immunocompromised pregnant women who can develop parasitosis in this situation. And even immunocompetent pregnant women can acquire a new infection. Therefore, all pregnant women should be advised on primary prevention measures. In a study carried out with professionals from Maringá, only 22% of the nursing team and 30.3% of doctors demonstrated knowledge about the conduct to be taken in cases of IgM and IgG anti- *Toxoplasma gondii* reagents and in cases of non-reactive IgM and IgG, only 48.5% nurses and 51.5% of doctors suggested the need for guidance on preventive measures and to repeat serology testing periodically.[10]

In the present study, it was evident that young adults, nurses, gynecologists, professionals who have more access to information and who carried out health education activities more frequently had greater knowledge about toxoplasmosis. This result suggests that professionals with higher education acquire more comprehensive knowledge during graduation compared to those with a technical level, and young adults probably graduated recently and so have more recent knowledge. Furthermore, it suggests that professionals who seek more scientific knowledge are more active in health education actions.

## CONCLUSION

The current research infers that there is a deficiency in the knowledge of health professionals, mainly about preventive measures, transmission routes, diagnosis and conduct in the face of suspected gestational toxoplasmosis. It also shows the lack of health education activities, both collective and individual, to prevent this parasitosis.

Therefore, the results show the importance of continuing education, so that professionals can discuss the topic and continuously plan health education strategies, highlighting, in particular, prevention, health promotion and prenatal care.

It is also important to have communication between the BHU and other points in the healthcare network, such as reference services for high-risk pregnancies and maternity wards, in order to discuss cases and provide better support, with the aim of qualifying professionals in the control and surveillance of gestational and congenital toxoplasmosis.

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