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## RESEARCH ARTICLE

# KNOWLEDGE, PRACTICES AND SEROPREVALENCE RELATED TO TOXOPLASMA GONDII INFECTION IN PREGNANT WOMEN IN MARRAKECH MOROCCO

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### ABSTRACT

**Aims:** To assess the knowledge of pregnant women about toxoplasmosis, to screen the main risk factors involved, and to evaluate the seroprevalence of this parasitosis in pregnant women in Marrakech. **Methods and Material:** Through a prospective study over a period of two months, from the beginning of October 2018 until the end of December 2018, two hundred and thirty-four pregnant women were invited to participate in our department of parasitology. They were interviewed with a structured questionnaire about known risk factors (age, meat consumption, contact with soil, and presence of cat...). Deferent parameters were collected and analyzed according to this questionnaire. Venous blood samples were taken. Sera were analysed for immunoglobulins (IgG and IgM) by ELISA using enzyme-linked immunosorbent assay. **Statistical analysis used:** Data entry was performed by double entry and data analysis was performed with the software Excel. Qualitative variables were presented as proportions. **Results:** A total of 234 women were included. Median age was 24 years old. And 64 women (27,35%) were found to be positive to total Ig and 16 out of 64 (25%) were positive to IgM. IgG avidity was low for two (12,5%), women, high for 14 women (87,5%). The seroprevalence of pregnant women immunized against toxoplasmosis in this study was 26,49%. There was an association between seropositivity and certain risk factors assessed. **Conclusion:** 73,51% were not immunized against toxoplasmosis, indicating a need for measures to prevent and control this infection during pregnancy.

## INTRODUCTION

Toxoplasmosis is a globally distributed disease caused by intracellular protozoa *Toxoplasma gondii* (*T. gondii*), which is highly successful parasite infecting approximately 30% of people worldwide (Halonen and Weiss, 2013; Cenci-Goga et al., 2011; Skariah et al., 2010). Previous studies indicate that the prevalence varies among different countries and within the country from one province to another, depending on alimentary habits, hygienic conditions, and the presence of the definitive host (cat) (Ramos et al., 2011; Gómez-Marin et al., 2011). Humans are infected by this parasite mainly by ingesting food or water that is contaminated with oocysts shed by cats or by eating undercooked or raw meat containing tissue cysts (Dubey et al., 2004; Dawson et al., 2005). The risk of exposure to toxoplasmosis can be reduced by improved personal hygiene and meat processing standards, as well as through effective environmental protection and health education (Pawlowski et al., 2001). One of the major consequences of pregnant women becoming infected by *T. gondii* is vertical transmission to the fetus. Although rare, congenital toxoplasmosis can cause severe neurological or ocular disease (leading to blindness), as well as cardiac and cerebral anomalies in the newborn (Montoya et al., 2004;

Jones et al., 2001). The risk of this transmission is low during early pregnancy but increases towards parturition. However, the earlier the fetus is infected, the greater the effects to the fetus and newborn. This underscores the need for early diagnosis and appropriate treatment as the most reliable ways of reducing the risk of transplacental transmission and subsequent sequelae in the newborn (Foulon et al., 1999; Pomares et al., 2016; Remington et al., 2014). Biological tests which detect toxoplasmosis infection mainly rely on serology for the detection of specific immunoglobulins (Ig) of the type IgM and IgG (Dabritz and Conrad, 2010). The aim of this study was to assess the knowledge of pregnant women about toxoplasmosis, to screen the main risk factors involved, and to evaluate the seroprevalence of this parasitosis in pregnant women.

## MATERIALS AND METHODS

**Study design:** A prospective study was conducted to assess the knowledge of pregnant women about toxoplasmosis, and to determine its seroprevalence and associated risk factors, over a period of two months from 1 October 2018 to 31 December 2018.

**Study population:** The participants included in the study were pregnant women attending prenatal care between the first of October 2018 and the 31 December 2018 after obtaining their approval for an informed consent.

**Data and sample collection:** A structured questionnaire was used to investigate known risk factors (age, consumption of raw or undercooked meat, consumption of raw or unwashed vegetables, contact with soil, and presence of cat). Samples of venous blood were collected, and Sera were obtained after five minutes' centrifugation at 3 000 r/min, analysed for immunoglobulins (IgG and IgM) by ELISA using enzyme-linked immunosorbent assay, then conserved at -20 °C in the laboratory of parasitology.

**Ethical considerations:** The participation in the study was on a complete voluntary basis and attested with a signed informed consent. The confidentiality of the obtained information was guaranteed by restricting the access to the study data to the responsible members of the research team.

**Statistical analysis:** Data entry was performed by double entry and data analysis was performed with the software Excel. Qualitative variables were presented as proportions.

## RESULTS

In total, two hundred and thirty-four pregnant women were included in this study. The median age was 24 years old with a minimum of 20 and maximum of 37 years old. Forty women (17,1%) were in their first trimester of pregnancy, 89 (38,03 %) women in their second trimester and 105 (44,87%) in the last trimester. One hundred and forty women (59,82%) already had multiple pregnancies and 94 women were primigravidae (40,18%). No woman had experienced a stillbirth. One hundred and eighty-eight women were living in urban area (80,34%), and 46 women in rural area (19,66%).

The knowledge of pregnant women about toxoplasmosis was assessed, 160 (68,37%) women had not heard about toxoplasmosis, 74 (31,62%) had information about this parasitosis, the source of information was essentially the internet (60%). Two hundred and thirty-four serum samples were analysed and 64 samples (27,35%) were found to be positive for total Ig against *T. gondii*. Among the positive sera, 16 (25%, n=64), were found to be positive for IgM (+IgG). Among these 16 positive sera in IgM, avidity was high in 14 women (87,5%), they were immunized against toxoplasmosis (after checking their other serology results), from which two were in their first trimester, five in their second and seven were in their third. Low avidity was found in two women (12,5%), and both women were in their third trimester of pregnancy. The global prevalence of anti *T. gondii* IgG antibodies in this population was 27,35% (all Ig positive sera contained IgG).

The seroprevalence of pregnant women immunized against toxoplasmosis in this study was 26,49% (62 women). Our study has reported a higher seropositivity rate among older age groups than in younger ones (75% of seropositive pregnant women were older than 33 years). The bivariate assessment of the risk factors showed an association between a positive serology and certain risk factors, including geographical origin, socio-economic level, study level, certain eating habits and daily activities (Table 1).

**Table 1. Sociodemographic characteristics and risk factors for toxoplasmosis**

	n	Seropositive	%
All	234	64	27,35%
<b>Residence</b>			
Urban area	188	30	15,95%
Rural area	46	34	73,91%
<b>Education level</b>			
Illiterate	25	15	60%
Elementary school	30	16	53,33%
Middle school	66	11	16,66%
High school	99	20	20,20%
University	14	2	14,28%
<b>Socio-economic level</b>			
High	12	2	16,66%
Medium	176	34	19,31%
Low	46	28	60,86%
<b>Consumption of raw vegetables</b>			
NO	138	33	17,55%
YES	46	31	67,39%
<b>Consumption of undercookedmeat</b>			
NO	215	62	26,49%
YES	19	2	10,52%
<b>Use of untreated water</b>			
NO	219	52	23,74%
YES	15	12	80%
<b>Contact with cat</b>			
NO	155	23	14,83%
YES	79	41	50,89%
<b>Contact with soil</b>			
NO	188	42	22,34%
YES	46	22	47,82%

## DISCUSSION

Toxoplasmosis is a parasitic infection of public health importance. Efforts to determine its sero-epidemiology, especially in high-risk groups such as pregnant women, are important to understand the distribution and level of exposure to this pathogen. These data can be useful for the design of toxoplasmosis control and prevention strategies. The current study was designed to assess the knowledge of pregnant women about toxoplasmosis, and to determine its seroprevalence and associated risk factors. The seroprevalence of toxoplasmosis was determined using a randomized sample of pregnant women and measuring the concentration of total Ig against *T.gondii*. Detection of IgM, IgG and IgG avidity measurements permitted to demonstrate exposure to *T. gondii* and at the same time determine whether the infection occurred recently or not. In the studied population, the seroprevalence of toxoplasmosis was less than the third of the studied population, of the pregnant women carried antibodies anti-*T. gondii* (total Ig).

**Seroprevalence:** The seroprevalence of pregnant women immunized against toxoplasmosis in our study was 26.49% indicating a considerable level of transmission, but less than the third of the study population. However, 73.51% of our population were seronegative and were susceptible to primary acute infection during pregnancy and possible fetal anomalies. Therefore, implementing health education especially on the aforementioned risk factors is recommended. This seroprevalence was substantially comparable to that found in studies done in Sri Lanka and in Benin respectively 29,9%, 36,1% and lower than previous studies conducted in Morocco Rabat, Casablanca, Nador, Tetouan and Kenitra respectively 50,6 % ,52 % , 34,3 % ,42 % and 37,7 % (El Mansouri *et al.*, 2007).

**Age of the population:** Our study reported a higher seropositivity rate among older age groups than in younger ones. A recent review of studies exploring seroepidemiology and *T. gondii*'s potential risk factors in various Arab and African contexts reached similar conclusions regarding the seroprevalence of *T. gondii* being significantly associated with a woman's age (Alsammani, 2016). Mwambe *et al.* (2013) reported that a woman's risk of *T. gondii* infection increases by 7% with each additional year of age. The possible reasons for this remain unclear and require further exploration, but previous authors have suggested that it may be due to more prolonged exposure to the identified risk factors, transmission routes, and the generally low public awareness of preventive methods (Mizani *et al.*, 2017).

**Seroprevalence and associated risk factors:** The lack of knowledge about toxoplasmosis, mode of transmission and means of prevention, the site of residence, the low socio-economic and educational level can be considered as the main risk factors of disease transmission. Thus, rural and poor as well as illiterate women were the most immunized against toxoplasmosis. The current study found that eating raw vegetables, using untreated water were associated with increased risk of *T. gondii* seropositivity. Similar to findings in this study, other studies have also reported this association between consumption of raw vegetables and use of untreated water and *T. gondii* infection (Yolande Sissinto Savi de Tové *et al.*, 2018; Bowie *et al.*, 1997). The consumption of inadequately cooked meat, even though reported in only 8.11% of the studied women, is also a non-negligible source of contaminations since meat can contain viable cysts. This consumption was associated with reduced *T. gondii* seropositivity. This result was comparable to that found in other studies conducted in Morocco and Turkey (El Mansouri *et al.*, 2007; Ertug *et al.*, 2005). And it contradicts with other studies conducted in Asia (Doudou *et al.*, 2014). A possible explanation for these results had to do with eating habits and food preparation practices in our studied population. In this study, the contact with cats and soil (involved in activities such as gardening and farming) are associated to higher risk for *T. gondii* infection. Previous studies have reported this association (Cook *et al.*, 2000; Lopes-Mori *et al.*, 2013).

### IgM positivity and IgG avidity

Among 234 pregnant women, 16 (6,83%, n=64), were found to be positive for IgM (+IgG). In general, IgM antibodies are detectable very soon (<1 week) after infection, but they can persist for a longer period of time after infection (+/-9 months). Consequently, The concomitant presence of IgM compared to IgG does not necessarily indicate an acute infection. Therefore, the IgG avidity was measured on the IgM positive samples. Among these 16 positive sera in IgM, avidity was high in 14 women (87,5%), they were immunized against toxoplasmosis (after checking their other serology results), The global prevalence of anti-*T. gondii* IgG antibodies in this population was 27,35% (all Ig positive sera contained IgG).

**Conflict of interest statement:** We declare that we have no conflict of interest.

**Applications:** The results presented can help the health authorities to give information and advices to pregnant women. This could lead to a potential decrease in the number of suspected congenital toxoplasmosis.

**Peer review:** This is an interesting short paper that gives recent data concerning the Toxoplasma seroprevalence in pregnant women in our country. The population studied was randomly selected and the results obtained can help to built local health policies in order to decrease the disease burden.

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