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Observational study to assess pregnant women's knowledge and behaviour related to toxoplasmosis in Essaouira province, Morocco

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ABSTRACT

Objective: To assess knowledge and behaviour related to toxoplasmosis which remains a neglected disease in Morocco. **Methods:** Observational investigations were conducted among 600 pregnant women from Essaouira Province. The interview items covered respondents' knowledge of the disease, its preventive practices and risk behaviours. **Results:** A total of 22/600 women had already carried out the anti-toxoplasmosis test, while, 96% have never done any screening of anti-*Toxoplasma* antibodies. Only 16/600 women have good information about the disease, its mode of transmission and its complications in both the fetus and his mother. Although most women adopt a healthy diet, the consumption of raw or undercooked meat is far to be considered as a risk factor, along with other potential factors that may foster the acquisition of the disease, such as possessing a domestic cat, educational status and knowledge of the disease. However, in this study, contact with soil was revealed the most important risk factor ($P = 0.045$), followed by the hygiene conditions after handling raw meat ($P = 0.048$). **Conclusion:** The underestimation of the *Toxoplasma gondii* sero-prevalence in Essaouira Province can be explained by the absence of toxoplasmosis serology in health institutions, as well as the gap of knowledge about the disease by local population.

1. Introduction

Toxoplasmosis is an anthroponosis caused by the protozoan *Toxoplasma gondii* (*T. gondii*) which is the most important parasite that infects mammals and birds worldwide[1]. It infects one-third of the world's population[2]. It is ranked third on the global scale of parasitic diseases in terms of importance and major risks that it is responsible for[3].

Although it is usually asymptomatic, *T. gondii* can cause opportunistic infections in humans and animals, in immunocompetent individuals[3,4]. Moreover, it may be responsible for a fatal disease in fetuses and immunodeficient patients[3,4].

Indeed, when a *T. gondii* infection is acquired in pregnancy, the parasite can be transmitted across the placenta to the fetus, resulting congenital toxoplasmosis, which can have severe consequences[5]. The clinical spectrum of fetuses, newborns and children congenitally infected with the parasite could range widely from complete asymptomatic form to severe neurological and ocular diseases, and even death[6]. According to the date of maternal infection, the risk of infection is believed to increase from the beginning to the end of pregnancy, while, severity decreases progressively[7,8].

It is now well accepted that congenital toxoplasmosis has a

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worldwide distribution with the global annual incidence estimated to 190 000 cases[9]. In Morocco, toxoplasmosis remains nationwide poorly documented despite the high national prevalence (50%) encrypted through serological analysis[10-12].

Many studies have shown that the epidemiological importance of the different routes of transmission of infection diseases depends largely on population behaviour and knowledge[13-17]. Knowledge is an important determinant to establish behavioural change. Good knowledge about the disease may help reduce risk of congenital toxoplasmosis, as it has been shown in Canada, in Poland and in Belgium[17].

The objective of our epidemiological study is to assess the knowledge and behaviour risk of toxoplasmosis in pregnant women of Essaouira Province where toxoplasmosis serology is not supported by health institutions.

2. Material and methods

2.1. Study design

This observational survey was conducted in different health institutions (public) of Essaouira Province (31°30'47"N 9°46'11"W). The total population of Essaouira Province is 450 527 habitants with 21% lives in urban areas[18].

Pregnant women were included in the study according to an accidental probabilistic sampling. In addition, we collected data about toxoplasmosis diagnosis at the Province exists only in private medical analysis laboratories due to their absence in public sector. Data were entered and analyzed by the statistical packages SPSS 20 software.

2.2. Questionnaire form

The semi-structured standardized interviews were used for data collection from eligible participants. The interview took approximately 30 minutes for each participant. The first section of the interview covered demographic (age), socio-economic (living area, professional activity, education level) and immune status data, while the second section covered data about knowledge and risk behaviour related to the disease.

2.3. Ethical considerations

Our study was conducted in full respect of local ethical considerations, namely obtaining authorization (N°004/17) from the regional and local Moroccan Ministry of Health services. After informing women by the aim of our research, we asked for their consent and their agreement to participate in the study. All participants provided informed consent and all data were collected under anonymity.

3. Results

Overall 600 women have participated in the present study, their age ranged between 18 and 41 years with 96% aged between 20 and 40 years and 82.5 % of the participant were from rural area.

A seroprevalence of 27.0% (162/600) was revealed among the 600 women of Essaouira Province. Indeed, of the 600 women, only 3.7% (22 women) carried out the screening test for *T. gondii* and 96.3% (578 women) have never benefited from an anti-toxoplasmic serological test and they were unaware of their immune status. Among the 22 (3.7%) women who carried out the anti-toxoplasmic test, we found that 72.7% (16 women) have been shown to be immunized and 27.3% (6 women) were not immunized. A total of 72.0% of immunized one are from rural areas.

According to data collected from the only private laboratory of Essaouira, the seroprevalence of *T. gondii* was 29.20%, 24.92% and 25.99% in Essaouira for years 2015, 2016 and 2017, respectively (Table 1).

Table 1

Toxoplasmosis seroprevalence from private laboratory (2015-2017) in Essaouira Province.

Year	Seropositivity	Seronegativity	Total	Seroprevalence(%)
2015	214	519	733	29.20
2016	158	476	634	24.92
2017	112	319	431	25.99

To assess the women's behaviour related to toxoplasmosis, the association between serological status and potential risk factors (Table 2) was assessed using the *Chi-square* test of Pearson (χ^2). This bivariate analysis has highlighted a statistical non-significant association of *T. gondii* infection and the possession of a feline ($P=0.727$) and the consumption of raw meat ($P=0.096$). While, the low level of hygiene after handling with raw meat ($P=0.048$) and contact with the soil ($P=0.045$) can be considered the main causes of the disease's transmission in the study area (Table 2).

Regarding participant's knowledge related to toxoplasmosis, only the women carried out the screening test (22/600) have confirmed knowing the disease, its mode of transmission and some complications in the fetus and in the mother. And 99% of women confirmed that they never read nor received documents or information about the toxoplasmosis.

4. Discussion

To assess the knowledge and behaviour risk of toxoplasmosis in Essaouira Province, we conducted epidemiological investigations among 600 pregnant women. And 82.5 % of the participant was from rural area, probably the rural population are more often to frequent public facilities.

Data about the immune status showed a seroprevalence of 2.7%. It is a very low value compared to national and regional

Table 2

Bivariate analysis of the different risk factors for toxoplasmosis in the region of Essaouira.

Risk factor		Seropositive (n)	Seronegative (n)	Total	Proprtions among seronegative women (%)	Proprtions among Seropositive women (%)	P value
Direct contact with cats	Yes	1	0	1	100.00	0.00	0.727
	No	15	6	21	71.43		
Cleaning the cat litter	Yes	0	0	0	-		0.727
	No	16	6	22	72.73	27.27	
Knowledge about the disease	Yes	16	6	22	72.73	27.27	-
	No	-	-	578	-	-	
Habitat	Rural	16	5	21	76.19	23.81	0.050
	Urban	0	1	1	0.00	100.00	
Education	Yes	9	0	9	100.00	0.00	0.585
	No	7	6	13	53.85	46.15	
Hygiene after handling soiled vegetables and fruits	Yes	9	6	15	60.00	40.00	0.180
	No	7	0	7	100.00	0.00	
Consumption of raw meat	Yes	3	3	6	50.00	50.00	0.096
	No	13	3	16	81.25	18.75	
Hand hygiene after handling raw meat	Yes	0	3	0	-	-	0.048
	No	16	0	22	72.73	27.27	
Hand hygiene after gardening	Yes	9	6	13	69.23	30.77	0.045
	No	7	4	9	77.78	22.22	

seroprevalences. Indeed, the seroprevalence of latent toxoplasmosis infection in pregnant women, in Morocco, is estimated to be around 51%[10,19]; while, the seroprevalence of pregnant women immunized against toxoplasmosis in Essaouira-Safi region was estimated to achieve 45 % [20]. In other regions of Morocco, El Mansouri *et al.*[21] have reported seroprevalences of 50.6%, 43.3 %, 42.6 % and 36.7 % in Rabat, Nador, Tétouan and Kénitra, respectively. In the present study, according to the private laboratory archives, the seroprevalence was about 26.7% between 2015 and 2017, while among 22 (3.7%) women who carried out the anti-toxoplasmic test, 72.7% have been shown to be immunized. Results underline the absence of exact data about the prevalence and the incidence of *T. gondii* in the study area. In the present study, we highlight also the access to the anti-toxoplasma serological tests is limited and absent in public hospitals and birthing centers of the study area. All women retained for this study have carried out the test in a private laboratory.

The most commonly identified sources of *T. gondii* infection in humans include the consumption of undercooked infected meat, tasting meat during cooking, unpasteurized milk, untreated water, contact with soil in contaminated fields, the contact with infected animals, during a blood transfusion or while traveling to areas where toxoplasmosis is important in terms of number of infections[22]. In the present study, a statistical non-significant association between the possession of a feline ($P=0.727$) the consumption of raw meat ($P=0.096$) and the disease was shown. Results may be linked to socio-cultural factors. The possession of feline is not common in Moroccan society neither consumption of raw meat. These results are consistent with the study of Said *et al.*[23] who showed that the interaction with cats and the consumption of raw meat are not associated with the disease.

In contrast, the lack of knowledge about the disease and soil contact

could be the main causes of toxoplasmosis infection in different regions of Morocco[11,20,21].

In the present study, only the women carried out the screening test (22/600) have confirmed a good knowledge about the disease. Studies from the United States have shown that most women of childbearing age and pregnant women had a limited knowledge of methods to prevent many infection diseases including toxoplasmosis[13]. Indeed, the participants' mean age was 27.5 years and 96% aged between 20 and 40 years which is reflecting a young population and corresponding to childbearing age.

Knowledge of the routes of transmission to humans is essential for the prevention of infection among risk groups such as susceptible pregnant women. Our results showed that the low level of hygiene ($P=0.048$) and contact with the soil ($P=0.045$) can be considered as the main causes of the disease transmission in Essaouira province. Soil may be the main cause (6% to 17% of cases) of the transmission of oocysts to people who had contact with it for extended periods of time[24]. It increases the risk of contracting the parasite because after contact with a soil containing cat faeces, the oocysts become infectious for 1-5 days following their sporulations[25].

The geo-demographic status is suspected to have a direct impact on the seropositivity of the disease because soil contact is more frequent in rural area. Toxoplasmosis has been associated with women of childbearing age and residence in rural areas in Colombia and in China[15,16]. In the present study, 72.0% of immunized women were from rural areas.

The absence of medical check and the scarcity of information, especially in hospitals, can be a high risk since the global knowledge of women is always basic to the disease (99% of women have never read about the toxoplasmosis). In addition, we noted 27.27% at least of seronegative pregnant women among the participants. The health

education for seronegative pregnant women is the most effective measure to prevent maternal infection[14,26].

Even though *T. gondii* has been identified as the food-borne pathogen associated with the second largest public health's impact in several developed countries, it remains neglected and poorly documented in Morocco given the lack of a National Program as with other parasitic diseases (Paludisme, Schistosomiasis and Leishmaniasis). Toxoplasmosis is a zoonosis with several interrelated factors (socio-cultural, demographic, and environmental factors) making the risk of contracting the disease more important.

Our study highlights the underestimation of the *T. gondii* seroprevalence in Essaouira Province. More than 96% of women were unaware of their immune status since screening tests are only done at private laboratories under the gynecologist request and only for pregnant women. Therefore, intensive health communication is needed for acquiring knowledge about the disease and behaviour change.

Conflict of interest statement

The authors declared that they have no conflict of interest.

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