Scientific Research Publishing

Open Journal of Immunology, 2022, 12, 122-129
https://www.scirp.org/journal/oji
ISSN Online: 2162-4526
ISSN Print: 2162-450X

Humoral Response to *Toxoplasma gondii* in Pregnant Women in Bangui Central African Republic

Wilfrid Sylvain Nambei[1], Junior Ouefio Nguerenam[1], Edwige Régina Kodia-Lenguetama[2], Arsène Gbamonza[3]

[1]Department of Science Biomedical, Faculty of Health Science, University of Bangui, Bangui, Central African Republic
[2]National Center of Blood Donor's, Ministry of Public Health, Bangui, Central African Republic
[3]Community Hospital of Bangui, Bangui, Central African Republic
Email: patmolhor@gmail.com, porzza@yahoo.fr, Wilfrid.nambei@gmail.com

How to cite this paper: Nambei, W.S., Nguerenam Jr., O., Kodia-Lenguetama, E.R. and Gbamonza, A. (2022) Humoral Response to Toxoplasma gondii in Pregnant Women in Bangui Central African Republic. *Open Journal of Immunology*, **12**, 122-129.
https://doi.org/10.4236/oji.2022.124008

Received: October 28, 2022
Accepted: December 25, 2022
Published: December 28, 2022

Abstract

Toxoplasmosis is a cosmopolitan antrhropozoonosis widespread in mammals and birds. Normally asymptomatic in the subject health, it can have serious consequences for the fetus in the first trimester of pregnancy in the pregnant woman. It is in this context that we propose to assess the immune response to *T. gondii* in pregnant women in Bangui. This was a retrospective analytical study that consulted the records of pregnant women received in prenatal consultations at the Bangui Community Hospital Maternity ward from January 2019 to December 2019. Socio-demographic and laboratory data (IgM, IgG response to *T. gondii*) and results of HIV serology were collected from January to June 2021. Chi^2 test was used. A total of 307 pregnant women were analyzed. The average age of the women included was 28 (±6) years. The average parity of the entire sample was 2.18 (±1.93). Toxoplasmosis infectious was 14.65%. Women with a positive IgM response accounted for 17.58% and those with an IgG-positive response for 42.99%. Patients with a positive HIV were 5.86%. Patients aged 20 - 29 had a serological profile suggesting a probable ongoing infection ($p = 0.010$). The paucipares were more represented with no statistically significant difference ($p = 0.23$). Pregnant women were not significantly exposed to toxoplasmosis infectious ($p = 0.96$). Immunized and non-immunized subjects were similarly exposed [OR = 0.97; CI 95% 0.4 = 6 - 2.05]. Toxoplasmosis remains particularly serious during pregnancy. Seroprevalence was significantly higher in the 20 - 24 year age group. Women were similarly exposed depending on whether they were immunized or not. This requires the establishment of a specific prevention program against this disease.

Keywords

T. gondii, Humoral Response, HIV, Pregnant Women, Central African Republic

1. Introduction

Toxoplasmosis, a cosmopolitan anthropozoonosis widespread in mammals and birds normally asymptomatic in healthy subjects, it can have serious consequences for the fetus in the first trimester of pregnancy and in the immunocompromised subject [1]. The prevalence of toxoplasmosis is heterogeneous and varies by country. In Europe it varied by country: 19% - 29% in Spain [2], 24% in Greece [3], 55% of pregnant women in France [4]. In Africa, it was 34.1% among pregnant women in Sudan [5], 47.9% among pregnant women in the Central African Republic in 2016 [6], 81% in Gabon, 78% in Nigeria and 60% in Côte d'Ivoire [7]. Transmission in humans is by ingestion of cyst contained in the cooked meats and oocysts eliminated by the definitive host in nature soiling water and food. Transmission can also occur from the mother to the child causing severe congenital toxoplasmosis with various malformations and late onset ocular lesions. The risk of maternal-fetal transmission of congenital toxoplasmosis increases with the age of pregnancy at the time of maternal infection, *Toxoplasma gondii* infection is responsible for severe encephalitis in nearly 40% of patients with acquired immunodeficiency syndrome (AIDS) and causes the death of about a third of these patients [8]. Toxoplasmosis is one of the most common congenital infections in the world [9]. It poses a significant threat, especially in early pregnancy, to the fetus because of the severity of the in utero manifestations and the devastating consequences for the infant. There is no vaccine to control this infection. It is in this context and in order to suggest a specific prevention programme that it seems appropriate to assess the immune to *T. gondii* in pregnant women in Central African Republic.

2. Materials and Method

2.1. Study Design

This was an analytical retrospective study that consulted the records of pregnant women who received prenatal consultations (PNC) at the Bangui Community Hospital maternity ward from January to December 2019. Data was collected from January to June 2021.

2.2. Data Collection

The data collected concerned: 1) socio-demographic characteristics which included at the time of the PNC: age, number of children born alive (parity), place of residence (urban and semi-urban areas), 2) serological status and reaction title, 3) Laboratory analytical method for the determination of anti-toxoplasmic IgG and IgM antibodies by the use of TOXO-HAI FUMOUZE® Diagnostics by

indirect haemagglutination reaction on U-bottom microplate with a sensitivity on pure serum of 0.10 IU/ml. The Combs immunoenzymatic test was used for the detection of toxoplasmosis-specific immunoglobulins M (IgM) with sensitivity and specificity of 93.3% and 100% respectively. HIV serology was performed by the technique ELISA using Genscreen HIV1/2 from Biorad (ELISA 1) and Vironostika HIV Uni-FormII plus O of Biometrics (ELISA 2) according to the national HIV testing.

2.3. Data Analysis

The data was collected using a laboratory register using a collection sheet and entered on an Excel 2010 file and analyzed with Epi-info 7© from CDC Atlanta and SPSS version 22. Measurements of central trend and dispersion were determined for age with a 95% confidence interval. The χ^2 test was used to compare the two proportions. The search for an association between the variables of the study namely; 1) socio-demographic variables (age, parity, place of residence), biological variables (IgM, IgG) and the occurrence of toxoplasmosis was done by logistic regression in multivariate analysis. The Odd ratio (ORs) was calculated as well as their confidence intervals, CI95%. For a p-value < 0.05, the Odd ratio value favoured a statistically significant association.

3. Results

3.1. Characteristic of Patients

A total of 307 cases of pregnant women were analyzed. Of these, 18 (5.86%) had HIV-positive serology. Toxoplasmic infection was 12.46%. The average age of pregnant women included was 28 ((±16) years. The average parity for the entire sample was 2.18 (±11.93). Similarly, the distribution of study subjects between semi-urban and urban areas was statistically similar with predominance (78.82%) in urban areas (p > 0.05) as shown in Table 1.

3.2. Distribution of IgM+ and IgG+ Antibodies by Study Variables

Women with a positive IgM response accounted for 17.58% or n = 54/307. Those with an IgG-Positive 42.99% or n = 132/307. The distribution by age group shows that patients aged 20 to 24 years had a serological profile suggesting a probable ongoing infection (p = 0.010). Similarly, this same age group was numerous in developing IgG antibody responses to the disease with a statistically different age group (p = 0.018). According to parity, the poor were more represented without any statistically significant difference (p = 0.23) as shown in Table 2.

3.3. Association between Toxoplasmic Status and Study Variables

At any age pregnant women were not significantly exposed to toxoplasmic infection (p = 0.96). In addition, women with HIV-positive serology appeared to be exposed to toxoplasmic infection [OR = 1.19; CI 95% = 0.79 - 1.78]. Similarly,

Table 1. Sociodemographic and laboratory characteristic of patients.

Variables	N = 307 (%)	p-value
Age (years), mean of age = 28 (±6)		0.015
14 - 19	31 (10.1)	
20 - 24	75 (24.42)	
25 - 29	78 (25.40)	
30 - 34	96 (31.28)	
35 - 44	27 (8,8)	
Parity, mean of parity = 2.18 (±1.93)		
Nulliparous	79 (25.73)	
Pauciparous	125 (40.71)	
Multiparous	103 (33.56)	
Toxoplasmic serology		**0.018**
positive	45 (14.65)	
négative	262 (85.35)	
HIV serology		
positive	18 (5.86)	
négative	289 (94.14)	
Residence		**0.25**
Urban	242 (78.82)	
semi urban	65 (21.18)	

Table 2. Distribution of antibodies according to the variables studied.

Variables Effect	Antibody response		p-value
	IgM+ n = 54 (%)	IgG+ n = 132 (%)	
Group of age (years)			0.018
14 - 19	10 (18.52)	13 (9.84)	
20 - 24	14 (25.92)	58 (43.94)	
25 - 29	13 (24.1)	29 (21.97)	
30 - 34	8 (14.9)	18 (13.64)	
35 - 44	9 (16.66)	14 (10.61)	
Parity			0.23
Nulliparous	15 (27.8)	28 (21.22)	
Pauciparous	26 (48.13)	65 (49.24)	
Multiparous	13 (24.07)	39 (29.54)	

Table 3. Bivariate analysis between toxoplasmic status and study variables.

Varibles Effect	Toxoplasmic status n= 307		ORbrut	IC95%	Chi²	p-value
	IgM+, n = 54	IgG+, n = 132				
Age (years)			0.78	[0.37 - 1.61]		0.96
14 - 19	10 (18.52)	13 (9.84)				
20 - 24	14 (25.92)	58 (43.94)				
25 - 29	13 (24.1)	29 (21.97)				
30 - 34	8 (14.9)	18 (13.64)				
35 - 44	9 (16.66)	14 (10.61)				
HIV serology			1.19	[0.79 - 1.78]		0.4
positive	18 (5.86)				11.15	
négative	289 (94.14)				9.96	
Parity					2.9	0.23
Nulliparous	15 (27.8)	28 (21.22)				
Pauciparous	26 (48.13)	65 (49.24)				
Multiparous	13 (24.07)	39 (29.54)				
Residence			1.4	[0.82 - 1.99]	2.13	0.13
Urban	242 (78.82)					
semi-urban	65 (21.18)					
Immunized status			0.97	[0.46 - 2.05]		0.96
Immunized	186 (60.58)					
Non Immunized	121 (39.42)					

according to the immune status of women, immunized subjects and non-immunized persons are equally exposed [OR = 0.97; CI 95% 0.4 = 6 - 2.05] with no statistically positive difference (p = 0.96) as shown in Table 3.

4. Discussion

Toxoplasmic infection is one of the most common congenital infections in the world. It poses a significant threat, especially in early pregnancy, to the fetus because of the severity of the in utero manifestations and the devastating consequences for the infant. The risk of congenital toxoplasmosis is often higher in co-infected HIV-Toxoplasmosis mothers than in monoinfected toxoplasmosis-only mothers [10]. The average age of our patients was 28 ± 6 years in this study. These results are similar to some previous work [11]. The seroprevalence of toxoplasmosis was 14.65% during this work. This seroprevalence was non-significantly high (p = 0.96) in the 20 - 24 year age group (24.42%) and in the paucipares (40.71%). These results corroborate those of some authors [11]

who had previously shown that the seroprevalence of toxoplasmosis in pregnant women varied by socio-demographic characteristics [11] [12]. This age variation was an expected outcome for an immunizing condition. Differences in the residence of seroprevalence observed in this study were already reported by some authors [11] [13]. This disparity could be explained by differences in dietary behaviour depending on the location of the residence where seroprevalence would be correlated to the temperate and humid climate promoting oocyst conservation in the soil [13]. Our study showed lower proportions of IgM and IgG antibodies anti *T. gondii* in pregnant women with a significant difference ($p = 0.018$) by age group but not statistically significant by parity ($p = 0.23$). Our results differ from those obtained in previous work where the authors had shown much higher proportions [14]. This difference between our results could likely be due to the use of the indirect haemagglutination technique which could lead to misinterpretation and lead to an underestimation of seroprevalence. This is a limitation in this study. Similarly, the study population differs from that used in some studies [6]. Furthermore, depending on the immune status, immune and non-immune women are equally exposed to toxoplasmic infection [OR = 0.97; CI 95% = 0.46 - 2.05]. These results assumed that pregnant women, residing in the environment where the parasite circulates, are exposed to recurrent infection, reinfection or even reactivation of a chronic T. gondii infection. Nevertheless, many of the studies have shown that congenital toxoplasmosis due to reactivation of maternal infection is less common than that usually observed [15] [16] [17]. In addition, our results showed that women with HIV-positive serology appeared to be exposed to toxoplasmic infection. Our results are in line with those obtained in previous work where the authors showed varying proportions in Congo [18] and Burkina Faso [19] in HIV-infected subjects. However, the proportion of vertical transmission of *T. gondii* infection in pregnant HIV+ infected women previously exposed to *T. gondii* is not yet well defined. Nevertheless, many of the studies have shown that congenital toxoplasmosis due to reactivation of maternal infection is less common than that usually observed [15].

5. Conclusion

Toxoplasmosis remains particularly serious during pregnancy. Seroprevalence of *Toxoplasma gondii* infection was lower in this study. It was also significantly higher in the 20 - 24 age group. There was no significant difference between urban and semi-urban areas. Women were similarly exposed depending on whether they were immunized or not. This requires the establishment of a specific prevention program against this disease.

Authors' Contributions

WSN conceived, designed, conducted the experiments, analyzed the data and prepared the manuscript. **JON** read and approved the final manuscript. **GA** collected the data and **REKL** read and approved the final manuscript.

Funding

No funding received.

Institutional Review Board Statement

This study protocol received full approval from the local Ethics committee of Health Science Faculty of University of Bangui and was conducted in compliance with the declaration of Helsinki. Approval reference number 18/FACSS/CES/21.

Data Availability Statement

Data is contained within the article.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

References

[1] Jones, J.L., Lopez, A., Wilson, M., *et al.* (2001) Congenital Toxoplasmosis: A Review. *Obstetrical & Gynecological Survey*, **56**, 296-305. https://doi.org/10.1097/00006254-200105000-00025

[2] Gutierrez-Zufiaurre, N., Sanchez-Hernandez, J., Munoz, S., *et al.* (2004) Seroprevalence of Antibodies against *Treponema pallidum*, *Toxoplasma gondii*, Rubella Virus, Hepatitis B and C and HIV in Pregnant Women. *Enfermedades Infecciosas y Microbiología Clínica*, **22**, 512-516. https://doi.org/10.1157/13067618

[3] Diza, E., Frantzidou, F., Souliou, E., *et al.* (2005) Seroprevalence of *Toxoplasma gondii* in Northen Greece during the Last 20 Years. *Clinical Microbiology and Infection*, **11**, 719-723. https://doi.org/10.1111/j.1469-0691.2005.01193.x

[4] Ancelle, T., Goulet, V., Tirad-Flury, V., Baril, L., *et al.* (1996) La toxoplasmose chez la femme enceinte en France en 1995. *Résultats d'une enquête nationale périnatale*. *BEH*, 51, 227-229.

[5] Elnahas, A., Gerais, A.S., Elbashir, M.I., Eldien, E.S. and Adam, I. (2003) Toxoplasmosis in Pregnant Sudanese Women. *Saudi Medical Journal*, **24**, 868-870.

[6] Nambei, W.S., Gamba, E.P., Tekpa, G. and Gbangbangai, E. (2016) Infection à T gondii chez les femmes enceintes infectées et non infectées par le VIH en Centrafrique. *RAMReS Sciences de la Sante*, **4**, 4-11.

[7] Dubey, J.P. (1998) Advances in the Life Cycle of *Toxoplasma gondii*. *International Journal for Parasitology*, **28**, 1019-1024. https://doi.org/10.1016/S0020-7519(98)00023-X

[8] Dunlop, O., Rootwelt, V., Sannes, M., *et al.* (1996) Risk of Toxoplasmic Encephalitis in AIDS Patients: Indication for Prophylaxis. *Scandinavian Journal of Infectious Diseases*, **28**, 71-73. https://doi.org/10.3109/00365549609027153

[9] Weiss, L.M. and Dubey, J.P. (2009) Toxoplasmosis: A History of Clinical Observations. *International Journal for Parasitology*, **39**, 895-901. https://doi.org/10.1016/j.ijpara.2009.02.004

[10] Odongo Osinde, M., Kakaire, O. and Kabonge, K.D. (2012) Sexually Transmitted Infections in HIV-Infected Patients in Kabala Hospital, Uganda. *The Journal of Infection in Developing Countries*, **6**, 276-282. https://doi.org/10.3855/jidc.1754

[11] Powers, K.A., Poole, C., Pettifor, A.E. and Cohen, M.S. (2008) Rethinking Heterosexual Infectivity of HIV-1: A Systematic Review and Meta-Analysis. *The Lancet Infectious Diseases*, **8**, 553-563. https://doi.org/10.1016/S1473-3099(08)70156-7

[12] Maïga, I., Kiemtoré, P. and Tounkara, A. (2001) Prevalence of Anti-Toxoplasma Antibodies in Patients with Acquired Immunodeficiency Syndrome and Blood Donors in Bamako. *Bulletin de la Société de Pathologie Exotique*, **94**, 268-270.

[13] Akanmu, A.S., Asunkalu, V.O., Ofomah, J.N. and Olowosenlu, F.O. (2010) Pattern of Demographic Risk Factors in the Seroprevalence of Anti-*Toxoplasma gondii* Antibodies in HIV Infected Patients at Lagos University Teaching Hospital. *Nigerian Quarterly Journal of Hospital Medicine*, **20**, 1-4. https://doi.org/10.4314/nqjhm.v20i1.57974

[14] Savi de Tové, Y.S., Hounto, A.O., Vodouhe, M.V., *et al* (2018) Séroprévalence et facteurs associés à la toxoplasmose chez la femme enceinte en milieu rural au Bénin. *Pan African Medical Journal*, **29**, Article No. 112. https://doi.org/10.11604/pamj.2018.29.112.14071

[15] Minkoff, H., Remington, J.S. and Holman, S. (1997) Vertical Transmission of Toxoplasma by Human Immunodeficiency Virus-Infected Women. *American Journal of Obstetrics & Gynecology*, **176**, 555-559. https://doi.org/10.1016/S0002-9378(97)70547-7

[16] Lebeach, M., Larsen, S.O. and Peterson, E. (1993) Prevalence, Incidence and Geographical Distribution of *Toxoplasma gondii* Antibodies in Pregnant Women in Demark. *Scandinavian Journal of Infectious Diseases*, **25**, 751-756. https://doi.org/10.3109/00365549309008574

[17] Hajsoleimani, F., Ataeian, A., Nourian, A.A. and Mazloomzadeh, S. (2012) Seroprevalence of *Toxoplasma gondii* in Pregnant Women and Bioassay of IgM Positive Cases in Zanjan Northwest of Iran. *Iranian Journal of Parasitology*, **7**, 82-86.

[18] Makuwa, M., Loemba, H., Ngouonimba, J., *et al*. (1994) Sérologie de la toxoplasmose et du cytomégalovirus des malades infectes par le VIH au Congo. *Cahiers Sante*, **4**, 15-19.

[19] Ledru, E., Diagbouga, S., Ledru, S., *et al*. (1995) A Study of Toxoplasma and Cytomegalovirus in Tuberculosis and HIV-Infected Patients in Burkina Faso. *Acta Tropica*, **59**, 149-154. https://doi.org/10.1016/0001-706X(95)00073-N