

# Toxoplasma gondii, HCV, and HBV Seroprevalence and Co-Infection Among HIV-Positive and -Negative Pregnant Women in Burkina Faso

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*Toxoplasma gondii* (*T. gondii*) infections can cause serious complications in HIV-infected pregnant women, leading to miscarriage, still-birth, birth defects (e.g., mental retardation, blindness, epilepsy etc.) and could favor or enhance the mother-to-child transmission of HCV, HBV, and HIV vertical transmission. From May 20, 2004 to August 3, 2005, 336 18–45 years aged pregnant women, were enrolled for an investigation of the prevalence of serum antibodies against *T. gondii*, HCV, HBV, and HIV using ELISA. The prevalence of *T. gondii*, HCV, and HBV in pregnant women was 25.3%, 5.4%, and 9.8%, respectively and the HIV serostatus (61.6%) seems to be associated with greater prevalence rates of both *T. gondii* (28.5% vs. 20.2%) and HBV (11.6% vs. 7.0%). Without taking into account HIV, only 65.5% (220 of 336) of the women were not infected with these agents. The co-infection rate between HIV-infected and -negative women was different statistically: *T. gondii*/HBV 0.048 versus 0.015, *T. gondii*/HCV 0.014 versus 0.008, and HCV/HBV 0.005 versus 0.008, respectively. The elevated co-infection rate in HIV-positive women demonstrated that they are exposed to *T. gondii*, HCV, and HBV infections prevalently by sexual contact. **J. Med. Virol.** 78:730–733, 2006. © 2006 Wiley-Liss, Inc.

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world, causes a variety of clinical syndromes in both human and animals [Ashburn, 1992].

The *T. gondii* seroprevalence estimated for human population varies greatly among different countries, among different geographical areas within the same country, and among different ethnic groups living in the same area. In sub-Saharan Africa the prevalence of *T. gondii*, HCV, and HBV increased at the same time on HIV. Toxoplasmosis prevalence: 75.4% in Nigeria [Onadeko et al., 1996]; 60% from AIDS patients in Côte d'Ivoire, at Yopougon, [Adou-Bryn et al., 2004]; 58.4% in Tunisia [Bouratbine et al., 2001]; 53.6% in Bénin [Rodier et al., 1995]; 40.2% in Senegal, at Dakar [Faye et al., 1998]; and 34.1% from pregnant women in Sudan [Elnahas et al., 2003].

The prevalence of HBV and HCV is also high in African countries: 14.3% HBV prevalence in Nigeria [Uneke et al., 2005]; 85% in adult population in Senegal [Sall Diallo et al., 2004]; 9.4% in Côte d'Ivoire [Rouet et al., 2004]; and 12.4% in Burkina Faso [Ilboudo et al., 2002]. The HCV prevalence is 4.4% in Kenya [Karuru et al., 2005]; 2.5% in Ghana [Lassey et al., 2004]; 6.9%, 14.4%, and 16.7% for the three Cameroon towns Yaounde, Ntem, and Mekas, respectively [Nerrienet et al., 2005] and, finally, 3.3% in Burkina Faso [Simpore et al., 2005]. The rate of co-infection between HCV and HIV in the present study was also high [Simpore et al., 2005]. The aims of the present study were to determine the seroprevalence of antibodies against *T. gondii*, HCV,

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## INTRODUCTION

*Toxoplasma gondii* (*T. gondii*), an obligate intracellular parasite found in many species throughout the

TABLE I. Correlation Between HIV Serological Status and T. gondii, HCV, and HBV Co-Infections

	T. gondii		HCV		HBV	
	Negative	Positive	Negative	Positive	Negative	Positive
HIV						
Negative (129)	103	26 (20.2%)	121	8 (6.2%)	120	9 (7.0%)
Positive (207)	148	59 (28.5%)	197	10 (4.8%)	183	24 (11.6%)
Total (336)	251	85 (25.3%)	318	18 (5.4%)	303	33 (9.8%)
$\chi^2: 1 \rightarrow 2$		0.087 (NS)		0.587 (NS)		0.167 (NS)

and HBV and to calculate the expected co-infection rate among HIV-infected and -negative pregnant women in Burkina Faso.

**MATERIALS AND METHODS**

**Samples**

Blood samples were collected at the Saint Camille Medical Centre (SCMC) in Ouagadougou, Burkina Faso, from May 20, 2004 to August 3, 2005. Three hundred thirty-six pregnant women, 18–45 years aged, average  $25.92 \pm 6.82$ , were enrolled at the Voluntary Counseling and Testing Programme. All the women had less than 32 weeks of amenorrhea at sampling time. Each person provided of informed consent before blood was taken for this survey and the study accomplishment was approved by the Ethics Committee of the Medical Centre.

**Laboratory Studies**

Ten milliliters of venous blood was drawn from each women. Within 3 hr after drawing blood, plasma was separated by centrifugation at 3,000 rpm, for 10 min and frozen at  $-50^{\circ}\text{C}$ , until testing.

HIV antibodies test was carried out by Enzyme Immuno Assay (EIA) technique (Abbott Laboratories, France, S.A Determine HIV-1 and Bio-Rad Laboratories, France, S.A Genie II HIV-2 test).

The RADIM EIA Kit test, Italy, was used to detect IgG and IgM T. gondii antibody in sera.

Sera were tested for hepatitis B surface antigen (HBsAg) and for antibodies to HCV antigens. In both cases, sera were re-tested by an Inter Second Antibody Immunoassay (ISAI) (Huma-Tech House Rapid Test, Germany), to confirm the results.

**Statistical Analysis**

Demographic and clinical profiles were recorded on computer files and analyzed by standard software SPSS-10 and EpiInfo-6. Statistical significance was set at  $P < 0.05$ .

**RESULTS**

Among 336 pregnant women attending an antenatal clinic, 207 were infected with HIV and 129 were negative (see Table I).

Eighty-five of 336 (25.3%) persons were positive for T. gondii IgG. Immunoglobulin M (IgM) among toxoplasmosis serologically positive women was not found. There was a significant age-dependent trend to T. gondii seropositivity: the toxoplasmosis prevalence rate increased significantly from 16.3% to 49.1% on going from 18–24 to 35–45 years old group subjects ( $P < 0.001$ ) (see Table II). T. gondii infection rate was influenced by the HIV status of the subjects: the prevalence of toxoplasmosis was 20.2% and 28.5% among HIV-negative and -positive women, respectively. (see Table I). Thirty-three of 336 (9.8%) women were infected actively by HBV at the time of sample collection. No difference in the mean age was found among HbsAg-positive and -negative individuals ( $P = 0.146$ ) (Table II). Moreover, an increase of HBV infection prevalence rate, was found among the 25–29 to the 30-34 years old group subjects, 6.1% versus 16.1%, respectively ( $P = 0.022$ ).

Table I shows that the HIV serostatus had no effect on the HBV infection rate: 7% of the HIV-negative subjects were infected by HBV, compared to 11.6% of the HIV-positive individuals ( $P = 0.167$ ).

Eighteen of 336 (5.4%) of the population tested was found to be HCV-seropositive (Table I), with no statistical difference in the mean age between

TABLE II. Prevalence of T. gondii, HCV, and HBV for Age Groups

Age groups (years)	Total	T. gondii			HCV			HBV		
		Negative	Positive	%	Negative	Positive	%	Negative	Positive	%
18–24	80	67	13	16.3	77	3	3.8	74	6	7.5
25–29	114	93	21	18.4	108	6	5.3	107	7	6.1
30–34	87	63	24	27.6	82	5	5.7	73	14	16.1
35–45	55	28	27	49.1	51	4	7.3	49	6	10.9
Total	336	251	85	25.3	318	18	5.4	303	33	9.8

TABLE III. Co-Infections Rates in HIV-Positive Mothers

HIV + (n=207)			T. gondii + (n=85)		
T. gondii	HBV	HCV	HIV	HBV	HCV
59 (28.5%)	24 (11.6%)	10 (4.8%)	59 (69.4%)	12 (14.1%)	4 (4.7%)
HCV + (n=18)			HBV + (n=33)		
HIV	HBV	T. gondii	HIV	HCV	T. gondii
10 (55.6%)	1 (5.56%)	4 (22.2%)	24 (72.7%)	1 (3.0%)	12 (36.4%)

HCV-seropositive and -seronegative patients ( $P = 0.525$ ) (see Table II). A constant prevalence rate: 3.8%, 5.3%, 5.7%, 7.3% in the 18–24, 25–29, 30–34, and 35–45 years old groups, respectively, was found. As reported in Table I, HCV infection rate was not affected by the HIV mother status: 6.2% of HIV-negative were HCV-positive compared to 4.8% of HIV-positive.

The co-infection rate among HIV-positive women (see Table III) was high. Indeed, 59 of 207 HIV-positive (28.5%) was found T. gondii-seropositive ( $P < 0.0001$ ); 24 of 207 HIV-positive (11.6%) ( $P < 0.0001$ ) were HBV-positive; and 10 of 207 HIV-positive (4.8%) were HCV-positive. The observed co-infection rate for these three infections was different from that expected in HIV-positive and in -negative mothers (see Table IV). However, no statistical significance was reached.

## DISCUSSION

Two hundred seven of 336 mothers were found HIV-positive and 25.3% (85 of 336) were found to be positive for T. gondii IgG antibodies. This value is similar to the seroprevalence data from some other African countries: 21.0% from blood donors in Mali [Maiga et al., 2001]; 18% in Niger [Julvez et al., 1996]; and 27% in Uganda [Zumla et al., 1991]. However, this result is substantially lower than values reported in Ethiopia 75.0% [Guebre-Xabier et al., 1993] and in Kenya 35–60% [Bowry et al., 1986]. On the other hand, an analogous study undertaken by Millogo et al. [2000] on 268 HIV-seropositive individuals at Bobo-Dioulasso, in Burkina Faso, yielded comparable prevalence (24.5%) of T. gondii ( $P = 0.341$ ).

On the other hand, a difference in the prevalence of Toxoplasmosis between HIV-positive and -negative pregnant women was found: 28.5% versus 20.2% (see Table I). An analogous difference of T. gondii infection among HIV-positive and -negative patients has been

reported in both Bamako (60% vs. 21.0%) and Uganda (34% vs. 27%) [Zumla et al., 1991; Maiga et al., 2001]. In the absence of prevention strategies, serious risks of acquiring primary infection during pregnancy in Burkina Faso exist, since almost 65% of pregnant women in Ouagadougou are T. gondii-seronegative. Moreover, a high-risk (34.5%) of infection by one of the three pathogenic agents (T. gondii, HCV, and HBV) in Ouagadougou occurs.

In addition, the risk of co-infection by both T. gondii/HBV, T. gondii/HCV, and HCV/HBV is 2.5%, 1.4%, and 0.5%, respectively. However, among the HIV-seropositive subjects, the expected risk of co-infection by T. gondii/HBV is high: (3.3% vs. 1.4% in HIV-negative women). The expected T. gondii/HCV co-infection probability is equal among HIV-positive and -negative mothers (1.4% vs. 1.2%). This is not a surprising observation since the HIV infection causes an immunodeficiency that favors T. gondii and HBV infections without a preferential transmission route [Gutierrez-Zufiaurre et al., 2004].

The T. gondii influence on the HIV evolution and vice versa is not clear. Nevertheless, the high rate of T. gondii/HBV observed co-infection, among the HIV-infected women in Burkina Faso (4.8%), demonstrates the existence of a correlation between these two pathogenic agents that, in turn, could influence mother-to-child transmission of HIV.

The HCV and HBV co-infection rate, among HIV-positive and -negative pregnant women attending at the medical center (0.5% vs. 0.8%), differs with respect to rate values reported in other countries, such as the Côte d'Ivoire (2.4% vs. 0.7%) [10] or in Malawi (2.1% vs. 1.4%) [Sutcliffe et al., 2003], thus suggesting different transmission routes in Burkina Faso: sexual, by blood transfusions, or by medical/ surgical interventions. When the parenteral way prevails the probability to

TABLE IV. Co-Infections Rates in HIV-Positive and -Negative Mother (Observed vs. Expected)

	Co-infection	Number observed	Frequency observed	Frequency expected	Number expected	P
HIV <sup>+</sup> N 207	T. gondii/HBV	10	0.048	0.033	6.8	0.457 NS
	T. gondii/HCV	3	0.014	0.014	2.9	0.681 NS
	HBV/HCV	1	0.005	0.006	1.2	—
HIV <sup>-</sup> N 129	T. gondii/HBV	2	0.015	0.014	1.8	0.681 NS
	T. gondii/HCV	1	0.008	0.012	1.5	0.615 NS
	HBV/HCV	1	0.008	0.004	0.5	NS

contract these pathologies is clearly elevated. The probability of acquiring HCV is lower than to acquire HBV [Simpore et al., 2005] for sexual transmission. Moreover, in Burkina Faso, HCV has a low pathogenicity both in the general population and in the group of pregnant women, with genotype 2a, known to be of low pathogenicity in all parts of the world [Simpore et al., 2005].

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