

Seroprevalences and Correlates of Hepatitis B and C Among Cameroonian Pregnant Women

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ABSTRACT

BACKGROUND AND RATIONALE: Viral hepatitis B (VHB) and viral hepatitis C (VHC) are major public health issues in resource-poor countries where vertical transmission remains high.

AIM: To assess prevalences and correlates of VHB and VHC among women attending antenatal clinic.

METHODS: A cross-sectional study at the Yaounde Central Hospital from January 1 to June 30, 2016. We included 360 pregnant women who were screened for hepatitis B virus surface antigen (HbsAg) and VHCAb by rapid diagnostic test (DiaSpot Diagnostics, USA) followed by confirmation of positive results by a reference laboratory. Odds ratios (95% confidence interval [CI]) were used to measure associations between variables. Statistical significance was set for P -value $<.05$.

RESULTS: Mean age was 27.9 ± 5.6 years. The prevalences of HbsAg and VHCAb were 9.4% ($n=34$) and 1.7% ($n=6$), respectively. Multiplicity of sex partners was significantly associated with HbsAg positivity (adjusted odds ratio [aOR]: 11.6; 95% CI: 5.1-26.7; $P<.001$) while none of the studied factors was associated with VHCAb.

CONCLUSION: The high prevalence of hepatitis B among pregnant women supports systematic screening and free vaccination of pregnant women and women of childbearing age.

KEYWORDS: Prevalence, correlates, viral hepatitis B, viral hepatitis C, pregnancy, Cameroon

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Introduction

Viral hepatitis B (VHB) and viral hepatitis C (VHC) are public health problems worldwide.¹ According to the World Health Organization (WHO), 350 million people are infected with hepatitis B virus (HBV) and 130 to 170 million are infected with hepatitis C virus (HCV) worldwide.² VHB and VHC have been named “silent killers” because they remain silent until complications such as cirrhosis and liver cancer.^{3,4} Their prevalences vary between continents and countries. Among Cameroonian adults, prevalences are 8% to 12% for VHB and 3.9% to 13% for VHC.⁵ Among Cameroonian pregnant women, Njouom et al⁶ reported a prevalence of 1.8% for VHC in 2003 and Fomulu et al⁷ reported a prevalence of 7.2% for VHB in 2013.

Without preventive measures, the rate of vertical transmission of HBV is 10% to 40% in the absence of viral replication and 70% to 90% in case of viral replication.⁸ The risk is 15% to 45% for HIV and much less for HCV (except in case of coinfection with HIV).⁹ Such high rates speak in favor of systematic screening of HBV during pregnancy. Antenatal care is

often the only contact of women with health facilities, thus offering a unique opportunity for screening VHB. Knowledge of hepatitis B status during pregnancy allows prevention of vertical transmission.¹⁰ Managing HBV-infected pregnant women gives an opportunity to screen their families. Our goal was to assess prevalences and correlates of VHB and VHC among women attending antenatal clinic.

Materials and Methods

We carried out a cross-sectional analytic study in the Obstetrics and Gynecology Unit of the Yaoundé Central Hospital (YCH) from January 1 2016 to June 30, 2016. The YCH is a referral secondary hospital that has the largest and oldest maternity of the Central Region (Cameroon), with more than 3000 deliveries every year. Most women followed up at the YCH are of low socioeconomic status.

The study population consisted of all pregnant women attending antenatal clinic (ANC) at the YCH during the study period.



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Were included all women attending ANC at the YCH who gave their written informed consent. We excluded women who, during the process, withdrew their consent and those who were lost to follow-up.

Sampling was consecutive and exhaustive. The Lorenz formula was used to determine the minimal sample size: $N = z^2 pq/d^2$, where z is the standard normal deviation at 1.96 (which corresponds to a 95% confidence interval [CI]); p is the prevalence of hepatitis B in pregnant women, estimated at 10.2% in 2015¹¹; $q = 1 - p$; and d is the degree of precision expected = 0.05. With this formula, our minimal size was 141. But to enhance the validity of our study, we decided to include all pregnant women fulfilling inclusion criteria (ie 360). During the study period, women who had several ANCs were included only once. The interview was face-to-face using a questionnaire with predefined answers.

Ethical clearance (No. 2015/61/ISTM/UD/CE) was obtained from the institutional ethics committee of the University of Douala. And administrative authorization was obtained from the Director of the YCH.

Data Collection

Participants were assigned codes for anonymity purposes. Data were then collected during face-to-face interviews using questionnaires with predefined answers. Sociodemographic parameters were age, marital status, occupation, level of education, and religion. Obstetrical parameters were gestity, parity, and gestational age. Past medico-surgical parameters were blood transfusion, dental care, and surgery. Family history of infection was evaluated with the following: HIV, VHB, and VHC among first-degree relatives. Behavioral risk was assessed through scarifications, multiple sexual partnership, and intravenous drug injections.

Venous blood (3 mL) was sampled to test for VHB and VHC. Blood samples were kept in ambient air to obtain serums that were used to carry rapid diagnostic tests. For HBV, we used DiaSpot HbsAg One step Hepatitis B Surface Antigen (HbsAg) Test Strip Package Insert and for hepatitis C, DiaSpot Hepatitis C virus-antibody (HCV-Ab) Test strips (both manufactured by DiaSpot Diagnostics, USA). Those are immunochromatographic strips for qualitative detection of antibodies and antigens. Their sensitivity and specificity are above 99% and 98%, respectively. All samples with positive tests were sent for quality control by the Pasteur's Institute of Cameroon. Concordance with our results was 100%. Sample carrying hepatitis B virus surface antigen (HbsAg) was further tested for Hbe antigen (HbeAg) and Hbe antibody (HbeAb). Results were disclosed to participants with proper counseling (disease progression, screening of partners, and serovaccination of newborns). All infected women were counseled on the disease and referred for proper specialized care.

Statistical Analysis

Data were analyzed using STATA version 12.0. Frequencies, means, medians, and standard deviations were determined. χ^2

and Fisher exact tests were used to compare frequencies and means. Statistical significance was set at P -value < .05. Unadjusted and adjusted odds ratios (95% confidence interval [CI]) were used to determine association between variables.

Results

Out of the 900 women seen at the antenatal unit, 360 (40%) gave their consent for the study. Mean age was 27.99 ± 5.63 years (range: 15-47 years). Ninety-one (25.3%) participants were primigravidae, and 145 (40.3%) of them were seen during the third trimester of pregnancy.

The seroprevalences of HBV and HCV were 9.4% (34/360) and 1.7% (6/360), respectively. None of the participants were co-infected by HBV and HCV.

Among HbsAg-positive women, 4 (11.8%) tested positive for HbeAg and 9 (26.5%) tested positive for HbeAb. Only 15 participants out of 360 (ie 4.2%) had been vaccinated against HBV. None of the patient's characteristic was associated with hepatitis C infection.

Table 1 shows associations of hepatitis B and C infections with patients' characteristics.

Table 2 shows associations between hepatitis B infection and risky behaviors.

Table 3 shows associations between hepatitis C infection and risky behaviors.

Table 4 shows the logistic regression using the two factors initially associated with HBV infections.

Discussion

The seroprevalence of hepatitis B among pregnant women in our study (9.4%) was similar to results previously reported in a rural (9.7%) and in an urban (7.7% and 10.2%) settings in Cameroon.^{7,11,12} In neighboring Gabon, a seroprevalence of 9.5% among pregnant women was reported in 2008 while Okoth et al¹³ reported 9.3% in Kenya in 2006.¹⁴ Among blood donors in Cameroon, the seroprevalence of HBV ranges from 10.8% to 12.4%.^{7,15} Our results are in accordance with WHO statement pointing Cameroon as a country of high endemicity for hepatitis B.¹ In our study, there was no association between blood transfusion, scarifications, family history of hepatitis B infection, and hepatitis B infection.

The seroprevalence of hepatitis C we found among antenatal clinic attenders (1.7%) is similar to the figures reported in the same country (1.8%) and in neighboring Nigeria (1.7%) and Benin (1.9%).^{6,15,16} However, higher seroprevalences have been reported in distant country such as Ghana (4.6%).¹⁷ An explanation may be found in the fact that investigators in those studies used RNA amplification techniques to screen pregnant women or hepatitis C.

In our study, pregnant women aged between 30 and 34 years were significantly more infected by HBV (OR = 2; 95%CI: 1.82-2.05; Table 1). Seid et al¹⁸ reported similar findings in Ethiopia in 2014. We found that multiple sex

Table 1. Associations of patients' characteristics with hepatitis B and C infections.

	CHARACTERISTICS	N	NO. (%)		OR (95% CI)	P-VALUE
	AGE, Y		HBSAG-POSITIVE	HBSAG-NEGATIVE		
Hepatitis B	15-19	12	1 (8.3)	11 (91.7)	0.53 (0.06-4.49)	1.00
	20-24	96	8 (8.3)	88 (91.7)	0.93 (0.84-1.04)	.24
	25-29	119	9 (7.6)	110 (92.4)	0.48 (0.19-1.19)	.16
	30-34	82	12 (14.6)	70 (85.4)	2 (1.82-2.05)	.03
	35-39	41	4 (9.8)	37 (90.2)	1.59 (0.48-5.26)	.058
	40+	10	0	10 (100)	NA	NA
			HCV AB-POSITIVE	HCV AB-NEGATIVE		
Hepatitis C	15-19	12	0	12 (100)	NA	NA
	20-24	96	0	96 (100)	NA	NA
	25-29	119	5 (4.2)	114 (95.8)	1.02 (0.3-1.93)	.63
	30-34	82	1 (14.2)	81 (98.8)	NA	NA
	35-39	41	0	41 (100)	NA	NA
	40+	10	0	10 (100)	NA	NA
			HBSAG-POSITIVE	HBSAG-NEGATIVE		
Hepatitis B	Single	246	24 (9.8)	222 (90.2)	1.12 (0.52-2.44)	.85
	Married	114	10 (9.0)	104 (91.2)		
			HCV AB-POSITIVE	HCV AB-NEGATIVE		
Hepatitis C	Married	246	4 (1.8)	242 (98.4)	0.93 (0.17-5.13)	1.00
	Single	114	2 (1.8)	112 (98.2)		
			HBSAG-POSITIVE	HBSAG-NEGATIVE		
Hepatitis B	Primary	30	3 (10)	27 (90)	0.84 (0.23-3.04)	1.00
	Secondary	163	19 (11.7)	144 (88.3)	1 (0.6-1.95)	.28
	University	167	12 (7.2)	155 (92.8)		.19
			HCV AB-POSITIVE	HCV AB-NEGATIVE		
Hepatitis C	Primary	30	1 (3.4)	29 (96.6)	1.41 (0.15-13.02)	.57
	Secondary	163	1 (0.6)	162 (99.4)	0.25 (0.03-2.27)	.37
	University	167	4 (2.4)	163 (97.6)	1.4 (0.15-13.02)	.56
			HBSAG-POSITIVE	HBSAG-NEGATIVE		
Hepatitis B	Nulliparous	117	12 (10.3)	105 (89.7)	—	—
	Primiparous	94	7 (7.4)	87 (92.6)	0.59 (0.22-1.54)	.35
	Pauciparous	108	13 (12.0)	95 (88.0)	1.3 (0.4-1.98)	.82
	Multiparous	25	1 (4.0)	24 (96.0)	3.28 (0.41-26.36)	.47
	Grand multiparous	16	1 (6.3)	15 (93.7)	2.05 (0.25-16.86)	.69
			HCV AB-POSITIVE	HCV AB-NEGATIVE		
Hepatitis C	Nulliparous	117	1 (0.8)	116 (99.2)	0.26 (0.03-2.36)	.36
	Primiparous	94	3 (3.2)	91 (96.8)	1.2 (0.18-5.68)	1

(Continued)

Table 1. (Continued)

CHARACTERISTICS	N	NO. (%)		OR (95% CI)	P-VALUE
		HCV AB-POSITIVE	HCV AB-NEGATIVE		
Pauciparous	108	2 (1.9)	106 (98.1)	2.16 (0.35-13.18)	.6
Multiparous	25	0	25 (100)	NA	NA
Grand multiparous	16	0	16 (100)	NA	NA

Abbreviations: CI, confidence interval; NA, not applicable; OR, odds ratio.

Table 2. Associations between risky behavior, past history factors, and hepatitis B infection.

RISK FACTORS	N	HBSAG-POSITIVE N=34	HBS-NEGATIVE N=326	OR (95% CI)	P-VALUE
Blood transfusion					
Yes	25	4 (16.0%)	21 (84.0%)	1.94 (0.62-6.01)	.28
No	335	30 (9.0%)	305 (91.0%)		
Scarifications					
Yes	107	11 (10.3%)	96 (89.7%)	1.15 (0.54-2.44)	.75
No	253	23 (9.1%)	230 (90.9%)		
Multiple sexual partners					
Yes	36	15 (41.7%)	21 (58.3%)	11.47 (5.11-25.74)	.0001
No	324	19 (5.9%)	305 (94.1%)		
Dental care					
Yes	94	13 (13.8%)	81 (86.2%)	1.87 (0.90-3.91)	.10
No	266	21 (7.9%)	245 (92.1%)		
History of surgery					
Yes	47	3 (6.4%)	44 (93.6%)	0.62 (0.18-2.12)	.60
No	313	31 (9.9%)	282 (90.1%)		
Family history of hepatitis B infection					
Yes	32	7 (21.9%)	25 (78.1%)		
No	208	9 (4.3%)	199 (95.7%)		.0003
Unknown	120	18 (15.0%)	102 (85.0%)		

Abbreviations: CI, confidence interval; NA, not applicable; OR, odds ratio.

After logistic regression using all initial significant associated factors, multiple sex partners remain the only independent factor associated with HbsAg.

partners was significantly associated with hepatitis B infection (OR = 11.47; 95%CI: 5.11-25.74; Table 4). Similar findings were reported in Nigeria and in the Kilimanjaro region.¹⁶⁻¹⁸ That finding is logical given that hepatitis B is sexually transmitted. Out of the 34 HbsAg-positive pregnant participants, 4 (11.8%) were HbeAg-positive, thus having a 70% to 90% risk of transmitting HBV to their babies.⁸ Other researchers reported a wide range of proportions of HbeAg carriers among AbsAg-positive pregnant women in Cameroon: 0% by Kfutwah et al,¹⁹ 12.1% by Noubiap et al,¹¹

41% by Frambo et al,¹² and 21% by Fomulu et al.⁷ This heterogeneity needs to be addressed by a nationwide large-scale study. Only 15 (4.2%) of our participants were vaccinated against hepatitis B. This confirms the small coverage previously depicted by Fomulu et al⁷ among antenatal clinic attenders in Yaoundé.

As several African authors in recent years, we observed that none of the risk factors were associated with VHC among pregnant women.²⁰⁻²² Nevertheless, blood transfusion was found to be associated with hepatitis C infection during pregnancy in Ghana.¹⁷

Table 3. Association between risky behavior, past history, and HCV infection.

VARIABLE	N=360	HCVAB POSITIVE N=6	HCVAB NEGATIVE N=354	OR (95% CI)	P-VALUE
Blood transfusion					
Yes	25	1 (4.0%)	24 (96.0%)	2.75 (0.31-24.49)	.352
No	335	5 (1.5%)	330 (98.5%)		
Tattoo					
Yes	31	1 (3.2%)	30 (96.8%)	2.16 (0.24-19.10)	.419
No	329	5 (1.5%)	324 (98.5%)		
Scarification					
Yes	107	2 (1.9%)	105 (98.1%)	1.19 (0.21-6.57)	1.000
No	253	4 (1.6%)	249 (98.4%)		
Piercing					
Yes	9	0 (0)	9 (100%)	—	1.000
No	351	6 (1.7%)	345 (98.3%)		
Multiple sex partners					
Yes	36	0 (0)	36 (100%)	—	1.000
No	324	6 (1.9%)	318 (98.1%)		
Dental care					
Yes	94	1 (1.1%)	93 (98.9%)	0.56 (0.06-4.87)	1.000
No	266	5 (1.9%)	261 (98.1%)		
History of surgery					
Yes	47	2 (4.3%)	45 (95.7%)	3.43 (0.61-19.29)	.177
No	313	4 (1.3%)	309 (98.7%)		
Family history of hepatitis C infection					
Yes	7	1 (14.3%)	6 (85.7%)		
No	227	2 (0.9%)	225 (99.1%)	—	.017
Unknown	126	3 (2.4%)	123 (97.6%)		

Abbreviations: HCV, hepatitis C virus; OR, odds ratio.
No risky behavior was associated with HCV infection.

Table 4. Logistic regression of factors associated with HBV infections.

VARIABLES	ADJUSTED OR	95% CI	P-VALUE
Age 30-34 years	1.106	0.15-7.97	.920
Multiple sex partners	11.62	5.057-26.731	<.001

Abbreviations: CI, confidence interval; HBV, hepatitis B virus; OR, odds ratio.
The only factor strongly associated with HBsAg is the multiplicity of sex partners.

Although our data were collected in a tertiary center, the results cannot be extrapolated to the whole country. Moreover, a selection bias cannot be excluded. Multicentric studies are needed to have a thorough appraisal of HBV and HCV infections among

pregnant women in Cameroon. We did not test for hepatitis B core antibodies which could have helped to decipher between chronic and acute infection on one hand and between naïve and spontaneously healed participants on the other hand.

Conclusions

Seroprevalences of hepatitis B and C among antenatal clinic attenders at the YCH were 9.4% and 1.7%, respectively. This calls for more actions toward prevention of mother-to-child transmission of hepatitis B. Screening during pregnancy should be systematic and more accessible rather than provider-initiated as it is the case nowadays. Free-of-charge serovaccination against hepatitis B of newborn may also be done at birth instead of only vaccinating at 42 days of live.

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Author Contributions

FYF conceived the study, collected and analyzed data, and wrote the manuscript. JHF, JTF, and LDF analyzed data and reviewed the manuscript. All the authors read and approved the final version of the manuscript.

Disclosures and Ethics

The authors have read and confirmed their agreement with the ICMJE authorship and conflict of interest criteria. The authors have also confirmed that this article is unique and not under consideration or published in any other publication and that they have permission from rights holders to reproduce any copyrighted material. Any disclosures are made in this section. The external blind peer reviewers report no conflicts of interest.

REFERENCES

- World Health Organization. Global hepatitis report, Geneva. 2017. <http://www.who.int/hepatitis/publications/global-hepatitis-report2017/en/>
- World Health Organization. World strategy project on the viral hepatitis sector, 2016-2021—first world. http://www.who.int/reproductivehealth/Hepatitis-global-strategy_Nov2015.fr.pdf. Published November 13, 2015.
- Pennap GR, Nwachukwu O, Ishaleku D, Ombugadu RJ. Hepatitis B virus carriage among students of a Nigerian Tertiary Institution: a cohort of eligible blood donors. *Res J Med.* 2011;5:903.
- Perz J, Armstrong G, Farrington L, Hutin Y, Bell B. The contributions of hepatitis B virus and hepatitis C virus infections to cirrhosis and primary liver cancer worldwide. *J Hepatol.* 2006;45:529–538.
- Pawlotsky L, Belec G, Gresenguet L, et al. High prevalence of hepatitis B, C, and E markers in young sexually active adults from the Central African Republic. *J Med Virol.* 1995;46:269–272.
- Njouom R, Pasquier C, Ayoub A, et al. Hepatitis C virus infection among pregnant women in Yaounde, Cameroon: prevalence, viremia, and genotypes. *J Med Virol.* 2003 69:384–390.
- Fomulu NJ, Morfaw FL, Torimiro JN, Nana P, Koh MV, William T. Prevalence, correlates and pattern of Hepatitis B among antenatal clinic attenders in Yaounde-Cameroon: is perinatal transmission of HBV neglected in Cameroon? *BMC Pregnancy Childbirth.* 2013;13:158.
- Ranger-Roger S, Alain S, Denis F. Hepatitis viruses: mother to child transmission. *Pathol Biol.* 2002 50:568–575.
- Public Health Agency of Canada. *Risk of HIV Transmission: Contents of Scientific Data.* Ottawa, ON, Canada: Public Health Agency of Canada; 2013.
- Lee C, Gong Y, Brok J, Boxall EH, Glud C. Effect of hepatitis B immunisation in newborn infants of mothers positive for hepatitis B surface antigen: systematic review and meta-analysis. *BMJ.* 2006 332:328–336.
- Noubiap JN, Nansseu JRN, Ndoula ST, Bigna JJR, Jingi AM, Fokom-Domgue J. Prevalence, infectivity and correlates of hepatitis B virus infection among pregnant women in a rural district of the Far North Region of Cameroon. *BMC Public Health.* 2015;15:454.
- Frambo AAB, Atashili J, Fon PN, Ndumbe PM. Prevalence of HBsAg and knowledge about hepatitis B in pregnancy in the Buea Health District, Cameroon: a cross-sectional study. *BMC Res Notes.* 2014;7:394.
- Okoth F, Mbutia J, Gatheru Z, et al. Seroprevalence of hepatitis B markers in pregnant women in Kenya. *East Afr Med J.* 2006;83:485–493.
- Makuwa M, Caron M, Souquière S, Malonga G, Mahé A, Kazanji M. Prevalence and genetic diversity of hepatitis B and delta viruses in pregnant women in Gabon: molecular evidence that hepatitis delta virus clade 8 originates from and is endemic in Central Africa. *J Clin Microbiol.* 2008;46:754–756.
- Fouelifack FY, Keugoung B, Fouedjio JH, Kouam N, Mendibi S, Dongtsa Mabou J. High rates of hepatitis B and C and HIV infections among blood donors in Cameroon: a proposed blood screening algorithm for blood donors in resource-limited settings. *J Blood Transfus.* 2012;2012:458372.
- Osazuwa F. Sero-epidemiology of human immunodeficiency virus, hepatitis B and C among pregnant women in rural communities of Abaji Area Council, Nigeria. *TAF Prev Med Bull.* 2012;11:431–438.
- Agyeman AA, Ofori-Asenso R, Mprah A, Ashiagbor G. Epidemiology of hepatitis C virus in Ghana: a systematic review and meta-analysis. *BMC Infect Dis.* 2016;16:391.
- Seid M, Gelaw B, Assefa A. Sero-prevalence of HBV and HCV infections among pregnant women attending antenatal care clinic at Dessie Referral Hospital, Ethiopia. *Adv Life Sci Health.* 2014;1:109–120.
- Kfutwah AK, Tejiokem MC, Njouom R. A low proportion of HBsAg among HBsAg-positive pregnant women with known HIV status could suggest low perinatal transmission of HBV in Cameroon. *Virol J.* 2012;9:62.
- Zenebe Y, Mulu W, Yimer M, Abera B. Sero-prevalence and risk factors of hepatitis C virus infection among pregnant women in Bahir Dar city, Northwest Ethiopia: cross sectional study. *Pan Afr Med J.* 2015;21:158.
- Kabinda JM, Akilimali TS, Miyanga AS, Donnen P, Michèle DW. Hepatitis B, hepatitis C and HIV in pregnant women in the community in the Democratic Republic of Congo. *World J AIDS.* 2015;5:124–130.
- Ugbebor O, Aigbirior M, Osazuwa F, Enabudoso E, Zabayo O, Ewing GW. The prevalence of hepatitis B and C viral infections among pregnant women. *N Am J Med Sci.* 2011;3:238–241.