

Prevalence of Hepatitis B and Associated Factors in the Garoua Central Prison, Cameroon: A Cross-Sectional Study

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Abstract

Introduction: Hepatitis B virus (HBV) infection is a major public health problem in Cameroon. Garoua city is the headquarters of the North Region of Cameroon, where the HBV prevalence is among the highest of the country. The aim of this study was to determine the prevalence of HBsAg carriage and associated factors among persons incarcerated in the Garoua Central Prison.

Methods: It was a cross-sectional study conducted from July 1 to July 31, 2023 at the Garoua Central prison. We included all prisoners willing to participate in the study and who gave their verbal consent. We collected data using a pre-established data entry form and we used rapid test for blood screening for HBV surface antigen (HBs Ag) with ELISA confirmation. Data were analyzed using the R[®] software for Windows. After the univariate analysis, we selected associated variables to HBV infection with p -value < 0.2 for a logistic regression model in order to look for independently associated factors to this HBV infection. The p -value was set at 5%. **Results:** We included 1389 prisoners out of which 97.6% were male. The median age (IQR) of the study population was 28 (23 - 35) years. The median (IQR) duration of incarceration was 12 (6 - 26) months and the mean ($\pm$ sd) number of incarcerations was 1.24 ($\pm$ 0.6). HBV prevalence was estimated at 14.8% (95% CI: 13.0 - 16.7). Upon uni- and multivariate analysis, no risk factor was significantly associated with viral hepatitis B infection in our study population. **Conclusion:** The

prevalence of Hepatitis B was high in the Garoua Central Prison, but there were no additional risk factors for HBV infection. There is a need to include the Garoua Central Prison and by the way other prisons in the country in the chronic viral hepatitis care program.

Keywords

Hepatitis B, Prison, Associated factors, Cameroon

1. Introduction

Hepatitis B virus (HBV) infection is a major public health problem in Cameroon which is in a high endemicity region for HBV infection and where the estimated global prevalence of HBV infection is 11.2% [1]. But there is a wide variation in that prevalence according to age and site of study, as shown by Nsenga Djapa *et al* in Ebolowa where the prevalence in adults on one hand and in children and teenagers on the other hand were respectively 8.9% and 1.9% [2] [3]. Garoua City is the headquarters of the North Region of Cameroon, where the HBV prevalence is among the highest in the country [4]. HBV prevalence in prisons setting varies from one country or region to another from 5.9% in Switzerland to 23.9% in Taiwan region [5] [6] [7] [8]. Although there is a controversy on whether the transmission rate is higher in prison or outside, the Hepatitis B prevalence estimates are usually higher in prisoners compared to that of the general population, and this may be explained by a poor access to appropriate health care service, overcrowding, poor nutrition state and higher exposure to other risk factors like unprotected sex and tattooing before or during incarceration [9] [10]. Moreover, a US CDC work group determined that persons incarcerated or formerly incarcerated in a jail, prison, or other detention setting should be considered at increased risk and therefore tested for HBV infection [11]. In Sub-Saharan Africa, there is a scarcity of data regarding the HBV infection in prisons. The aim of this study was to determine the prevalence of HBsAg carriage and associated factors among persons incarcerated in the Garoua Central Prison.

2. Methods

2.1. Study Design and Setting

It was a cross-sectional study conducted among occupants of Garoua Central Prison from July 1 to July 31, 2023. Garoua City is the headquarters of the North Region, with an estimated population of 370,000 inhabitants in early 2023 [12]. There were approximately 1700 permanent detainees according to the prison administration office and there are 09 health professionals delivering healthcare service. The prison has 15 carceral rooms divided into 5 quarters for different groups of persons: male teenagers (below 18 years old), male adults (between 18

and 55 years old), male elders (above 55), females of all age groups, and the last quarter consisting of an area where males of all age groups are sent in case of illness. During admission, every prisoner is systematically screened for Human Immunodeficiency Virus (HIV) and put on treatment if needed according to the prison's medical staff, but HBV screening is not done.

2.2. Sample Size and Sampling Technique

The minimal sample size for this study was calculated using OpenEpi [13] and was set at 402 individuals considering the confidence interval at 95% and the precision at 1%. The selection of participants was empirical. We consecutively included all prisoners willing to participate to the study and who gave their verbal consent. We did not include minor prisoners in our study.

2.3. Data Collection and Laboratory Method

We collected data using a pre-established data entry form organized in the following sections:

- Sociodemographic data: age, gender, marital status, education level;
- Incarceration history: number of incarcerations and duration of incarcerations;
- Risk factors of HBV infection: number of sexual partners, history of male to male sexual intercourse, history of blood transfusion, history of surgery, dental extraction, sharing of sharp materials in prison like needles or razor blades, injectable drug use (IDU), tattooing practice or ear-piercing, and history of sexually transmitted diseases;
- History of HBV immunization;
- Results of the HBV screening.

For hepatitis B infection screening, five milliliters of venous blood were collected with a plain tube from each study participant by trained laboratory personnel. The blood sample was allowed to clot at room temperature and centrifuged at 5000 rpm for 15 minutes, and then the serum separated. The serum specimen was tested for HBsAg using the CTK's Onsite[®] rapid lateral chromatographic immunoassay test kits developed by CTK Biotech (Poway, CA, USA). This test kit with a relative sensitivity of 100% and relative specificity of 99.1% according to the manufacturer was used for qualitative detection of HBsAg in the serum. Inmates who tested positive on the rapid test had a confirmatory ELISA test.

HBV infection was diagnosed when HBsAg was detected in the sample by both the rapid-using test and the ELISA test. The outcome variable was the presence of HBV infection, while sociodemographic characteristics and risk factors of HBV transmission were the predictor variables.

We obtained an administrative authorization from the Garoua Central Prison's administration and an ethical clearance (N° 0009/CERSH/NO/2023) from the North Regional Ethics Board on Medical Research. Prisoners confirmed pos-

itive for viral hepatitis were referred to the medical doctor in charge of the North prisons health service for proper management in collaboration with a gastroenterologist.

2.4. Statistical Analyses

Data were analyzed using the R[®] software for Windows version 4.2.1 [14]. The results were expressed in counts and percentages for qualitative variables. For quantitative variables, mean $\pm$ standard deviation (sd) for normally distributed variables, or median with interquartile range (IQR) were considered where appropriate. Comparison of categorical variables was done using Chi-square test or Fisher test whereas comparison of quantitative variables was done using t-test or Mann-Whitney test where appropriate. After the univariate analysis, we selected associated variables to HBV infection with p -value < 0.2 for a logistic regression model in order to look for independently associated factors to this HBV infection. The p -value was set at 5%.

3. Results

We included 1389 detainees out of 1700, representing 81.7% of prisoners. The median age (IQR) was 28 years (23 - 35). The mean age was 30.3 ± 9.2 years. Male gender represented 97.6% ($n = 1355$) of our sample, giving a sex ratio (M/F) of 39.9/1. Thirty-seven percent of detainees received no formal education and the most represented marital status was that of “single” group which counted 726 (52.3%) detainees (Table 1). The mean ($\pm$ sd) number of incarcerations was $1.24 (\pm 0.6)$, with the median (IQR) duration of incarceration of 12 (6 - 26) months. Hepatitis B virus global prevalence was estimated at 14.8% (95% CI: 13.0 - 16.7). The prevalence was estimated at 14.9% (95% CI: 13.1 - 16.9) in males and 8.8% (95% CI: 3.0 - 22.9) in females. However, this difference was not statistically significant ($p = 0.3232$). Upon univariate analysis, Age (OR: 1; 95% CI [1 - 1.0], $p = 0.109$), Injection drug use (OR: 1.3; 95% CI [1 - 1.8], $p = 0.06$), past history of HBV screening (OR: 1.5; 95% CI [0.8 - 2.4], $p = 0.186$) and a past history of surgery (OR: 0.3; 95% CI [0.1 - 1], $p = 0.12$) were selected for multivariate analysis. Other socio-demographic parameters like gender (OR: 0.6; 95% CI [0.2 - 1.4], $p = 0.345$), level of education (OR: 1.03; 95% CI [0.8 - 1.4], $p = 0.857$ - OR: 1; 95% CI [0.7 - 1.3], $p = 0.786$ and OR: 1; 95% CI [0.3 - 2.3], $p = 0.950$ respectively for Primary, Secondary and University level) and marital status (OR: 1.1; 95% CI [0.9 - 1.4], $p = 0.4191$ and OR: 0.3; 95% CI [0.1 - 0.9], $p = 0.0848$ and OR: 0.5; 95% CI [0.03 - 2.1], $p = 0.5129$ respectively for married, divorced and widow status) were not statistically associated with hepatitis B infection. Incarceration history also did not interfere with the hepatitis b infection status (Table 2). Table 3 summarized the multivariate analysis and showed that none of the included risk factors were associated with hepatitis B infection, although past history of surgery had an adjusted OR of 0.3 (95% CI: 0.05 - 1) but this was not statistically significant since $p = 0.0881$.

Table 1. Socio-demographic characteristics of prisoners and prevalence.

Variables	Overall	Positive HBsAg	Negative HBsAg	p-value
Count [n (%)]	1389 (100%)	205 (14.8%)	1184 (85.2%)	/
Age [mean ($\pm$ sd)]	30.3 ($\pm$ 9.2%)	29.3 ($\pm$ 8.6)	30.5 ($\pm$ 9.3)	0.105
Gender				0.3232
Male	1355 (97.6%)	202 (14.9%)	1153 (85.1%)	
Female	34 (2.4%)	3 (8.8%)	31 (91.2%)	
Level of education				0.979
None	514 (37.0%)	76 (37.1%)	438 (37.0%)	
Primary	507 (36.5%)	77 (37.6%)	430 (36.3%)	
Secondary	347 (25.0%)	49 (23.9%)	298 (25.2%)	
University	21 (1.5%)	3 (1.5%)	18 (1.5%)	
Marital status				0.148
Single	726 (52.3%)	105 (51.2%)	621 (52.4%)	
Married	604 (43.5%)	97 (47.3%)	507 (42.8%)	
Divorced	46 (3.3% [*])	2 (1.0%)	44 (3.7%)	
Widow	13 (0.9%)	1 (0.5)	12 (1.0)	
Number of incarceration [mean ($\pm$ sd)]	1.24 ($\pm$ 0.6)	1.27 ($\pm$ 0.5)	1.23 ($\pm$ 0.6)	0.394
Duration of incarceration in months [median (IQR)] : 12 (6 - 26)				

HBsAg: Hepatitis B surface antigen; sd: Standard deviation; IQR: Interquartile range.

Table 2. Univariate analysis of HBV infection associated factors.

Variables	Categories	OR	95% CI	p
Age	/	1	1 - 1.0	0.109
Gender	Male	1		
	Female	0.6	0.2 - 1.4	0.345
Education level	None	1		
	Primary	1.03	0.8 - 1.4	0.857
	Secondary	1	0.7 - 1.3	0.786
	University	1	0.3 - 2.3	0.950
Marital status	Single	1		
	Married	1.1	0.9 - 1.4	0.4191
	Divorced	0.3	0.1 - 0.9	0.0848
	Widow	0.5	0.03 - 2.1	0.5129
HBV immunization	No	1		
	Yes	0.8	0.2 - 1.9	0.647
MSM	No	1		
	Yes	1.1	0.3 - 2.5	0.898

Continued

Past history of surgery	No	1		
	Yes	0.3	0.1 - 1.0	0.12
Past history of transfusion	No	1		
	Yes	1.02	0.5 - 1.8	0.957
Past history of dental care	No	1		
	Yes	0.8	0.5 - 1.1	0.242
Sharing of sharp objects	No	1		
	Yes	1.1	0.8 - 1.4	0.531
Injectable drug Use (IDU)	No	1		
	Yes	1.3	1 - 1.8	0.0646
Non injectable drug use	Non	1		
	Oui	1.001	0.759 - 1.305	0.996
Tattoos	No	1		
	Yes	0.7	0.4 - 1.2	0.283
Piercing	No	1		
	Yes	0.9	0.5 - 1.6	0.794
Past history of STD	No	1		
	Yes	1	0.6 - 1.5	0.891
Past history of HBV screening	No	1		
	Yes	1.5	0.8 - 2.4	0.186
Number of incarcerations	/	1.1	0.9 - 1.4	0.395
Duration of incarceration	/	1	1 - 1.002	0.274
Number of sexual partners	/	1.01	0.9 - 1.1	0.795

HBV: Hepatitis B virus; OR: Odds ratio; CI: confidence interval; MSM: men having sex with men; STD: sexually transmitted diseases; HCV: hepatitis C virus; HIV: human immunodeficiency virus.

Table 3. Multivariate analysis of HBV infection associated factors.

Variables	Categories	aOR	95% CI	<i>p</i>
Age	/	1	1 - 1.0	0.0955
Past history of surgery	No	1		
	Yes	0.3	0.05 - 1	0.0881
Injectable drug Use	No	1		
	Yes	1.4	0.9 - 2	0.0955
History of HBV screening	No	1		
	Yes	1.7	0.8 - 3.5	0.1595

aOR: Adjusted Odds Ratio; CI: Confidence interval.

4. Discussion

The aim of this study was to determine the prevalence of Hepatitis B infection in the Garoua Central Prison and associated factors. In this prison, detainees were mostly of male gender, with the median age (IQR) of 28 years (23 - 35). As for the prevalence, it was estimated at 14.8% (95% CI: 13.0 - 16.7). As far as the associated factors were concerned, no risk factor was significantly associated with HBsAg positivity in our study. Because of overcrowding and injection drug use in prisons, detainees are at higher risk of infectious diseases among which hepatitis B is a major problem [15]. Furthermore, data on HBV infection in a given group of population is important for planning of care and preventive measures implementation, including immunization campaigns targeting this group. This prevalence of 14.8% in our study, which is considered as high, is in line with the HBsAg prevalence of 12.9% in blood donors at the Garoua Regional Hospital, the prevalence of 12.9% in the Douala New Bell Prison, Cameroon and the global prevalence of 11.2% in the country [1] [6] [16]. It is also in line with the hepatitis B infection prevalence in studies conducted in prisons in Ghana, Nigeria, Togo and Senegal which were estimated at 17.4%, 13.7%, 10.9%, and 14.1% respectively [17] [18] [19]. But it is in contrast with the prevalence of less than 7% of HBV infection in prisoners in Ethiopia, India and Switzerland [5] [20] [21]. This tends to confirm the fact that the prevalence of HBsAg in prisoners in west and central Africa is the highest across the WHO regions [15]. In contrast with Kowo *et al* [6] in Douala New Bell Prison where male-to-male sex, sharp objects exchange and illicit drug use among others were important associated factors, no risk factor was significantly associated with hepatitis B upon multivariate analysis in our study. Though we hypothesize that injection drug use and male-to-male sex were underreported because both are illegal in Cameroon, detainees did not want the circuit of drug and the injection material to be discovered and the taboo between males in our context, our results may just be the confirmation of the fact that the risk factors we studied must be considered as additional risk factors, since the main routes of transmission of hepatitis B in high endemicity regions (Sub-Saharan Africa and Eastern Asia) are the mother-to-child transmission and the early horizontal transmission [22].

Though its monocentric nature is a limitation, our study targeted the main prison in the region with the highest prevalence of HBV in our country and included most of the detainees.

5. Conclusion

The present study found that the prevalence of Hepatitis B was high in the Garoua Central Prison. Although no additional risk factors for HBV infection were found among prisoners, there is a need to include the Garoua Central Prison and by the way other prisons in the country in the chronic viral hepatitis care program which should include HBV vaccination and comprehensive healthcare services.

Conflicts of Interest

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

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Appendix: Questionnaire (Data Collection Form)

Form N° _____

Name initials: _____ Age: _____ Years _____ Sex: M ☐ F ☐Level of Education: None ☐ Primary ☐ Secondary ☐ University ☐Marital Status: Single ☐ Married ☐ Divorced ☐ Widow/Widower ☐Vaccination against Hepatitis B: Yes ☐ No ☐

Number of incarcerations: _____ Duration of actual incarceration: _____

Number of sexual partners before incarceration: _____

Male-to-male sexual contact (Question concerning males only): Yes ☐ No ☐Past History of surgery: Yes ☐ No ☐Past History of blood transfusion: Yes ☐ No ☐Past History of dental care: Yes ☐ No ☐Sharing of syringes or razor blades: Yes ☐ No ☐Use of injectable drugs: Yes ☐ No ☐Presence of tattoo: Yes ☐ No ☐Piercing of ears or other body parts: Yes ☐ No ☐Past History of Sexually transmissible Infection: Yes ☐ No ☐Hepatitis B screening done in the past: Yes ☐ No ☐Results of hepatitis B (HBsAg) rapid test: Positive ☐ Negative ☐Results of hepatitis B confirmation test (ELISA): Positive ☐ Negative ☐