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Hepatitis B Virus and Behavioural Risk among Blood Donors, Gabon

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Authors' contributions

This work was carried out in collaboration among all authors. Author DMB initiate the study concept and designed the study. Author ORP carried out data collection and laboratory analysis. Authors ORP, TN and JF supervised the data collection and laboratory analysis. Author DMB analyzed the data and prepared the first manuscript draft. All authors read, reviewed and approved the draft final manuscript.

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Original Research Article

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ABSTRACT

Background: In resource- limited setting, co-infection between HIV and hepatitis B virus (HBV) poses important public health considerations. This cross-sectional study was undertaken with the aim of determining HBV seroprevalence patterns in urban blood banks.
Methods: A cross-sectional study was conducted at an urban blood bank setting. A total of 1610 blood donors were enrolled, and 283 consecutive plasma samples with unknown HBsAg status were selected for risks factors. HBV seroprevalence was based on the Chemiluminescence method (Cobas® e601, Roche). Potential risk factors associated with overt HBV infection were assessed by calculating the crude and adjusted odds ratio, 95% confidence intervalley (95% CI) and p values.
Results: Of 1610 participants, overall rate seroprevalence of HBsAg was 5.5% (95% CI: 4.36%–6.58%) ranging from 0.06% (95% CI: 0-0.18) (HCV) to 0.12% (95% CI: 0-0.30) (Syphilis). Seroprevalence of infection increased in older age groups (20-39 years) but men had a statistically

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significant higher prevalence of overt HBV infection than women (*P=0.0001*). The multivariate model showed the following to be predictors of HBV infection: male gender (OR=2.5 (95% CI 1.14-5.58), *P= 0.02*), first-time donor status (OR = 11.06, (95% CI 5.34-22.9), *P= 0.01*) and residence outside of Libreville (OR = 2.52, 95% CI 1.09-5.83), *P=0.03*).

Conclusion: HB and co-infection are n o t common in Gabon. Intermediate seroprevalence was associated with male gender, first-time donor status and residence outside of Libreville. HCV and HBV infection among the younger age groups are becoming an alarming issue. Prevention and control of HBV infection are needed to reduce HBV transmission.

Keywords: Blood transfusion; HBV co-infection; transfusion-transmissible infection; Africa.

1. INTRODUCTION

"Blood transfusion forms part of the backbone of basic medical care in sub-Saharan Africa (SSA), in particular, its use is crucial in limiting mortality associated with malaria and obstetric blood loss" [1]. "Hepatitis B virus (HBV) infection is a serious worldwide public health concern and is a major cause of chronic hepatitis, cirrhosis, and hepatocellular carcinoma: an estimated 2 billion people have evidence of prior infection and 350–400 million persons are infected chronically" [2].

"Chronic hepatitis B prevalence, as indicated by the presence of circulating HBsAg, estimates of the prevalence of HBV co-infection among HCV-infected Africans vary from approximately 5 to 20% but the prevalence and epidemiology of HCV-HBV co-Infection is unknown in many sub-Saharan African populations" [3]. "The endemicity of HBV infection varies greatly over the world, from highly endemic areas (> 8% infection rate), to intermediate (2−8%) and low endemicity areas (< 2%). Africa is among the highly endemic areas" [4].

"In some countries, such as Cameroon, Gabon and Republic Centre Africa (RCA), a large part of the population will be exposed in the course of their lives to HBV and become infected" [5,6,7]. "All of Central and Southern Africa is also in the high endemicity category" [8,9]. Few studies evaluated the status of HBV co infection among donors at the urban blood bank in Gabon. In 2019, Groc et al. [10] reported "a HBV prevalence of 7.4% among general population survey and that infection was associated with certain host factors (presence of viral co-infections), demographics and behavioral risk factors".

"In Gabon, in a recent report, a prevalence of 7.28% for HBsAg was reported among first-time donors in Libreville" [11]. Given that little is known on the epidemiology of transfusion transmitted infection (TTIs) in urban areas of Gabon [12,13]. Data obtained from the study will permit to see the relative safety of donated bloods for transfusion there by health policy makers may consider a better diagnostic scheme. Also, evaluation of potential risk groups and the extent of factors will strengthen the decision on selection of low-risk donor, proper collection and application of better screening methods there by, safe and adequate blood donation for transfusion will be guaranteed.

We have set for this study the goal of determining HBV seroprevalence patterns in urban blood banks.

2. MATERIALS AND METHODS

2.1 Sample Size Determination and Sampling Techniques

A total of 1610 blood donors were enrolled, and 283 consecutive plasma samples were selected for risk factors. Informed consent was taken from patients and controls and ethical clearance was obtained from the Gabonese National Ethical Committee for research (authorization n° 0088/2019/PR/SG/CNER). A questionnaire was filled out for all cases and controls, which contained the basic information about the individual like age, gender, blood donor status, residence, blood exposure, vaccination. The questionnaires were self-administered by subjects or any subjects who needed help in filling them were assisted by trained volunteers who were medical doctors, medical laboratory scientists, medical laboratory science students, and laboratory technologists.

2.2 Laboratory Methods

Plasma from all the samples were screened for HBV infection by the chemiluminescence method using the COBAS® e601, Roche according to the manufacturer's instructions.

2.3 Statistical Analysis

Statiscal analyses were conducted using SPSS 22.0 statistics software. The Chi-square test was applied to assess the association between the categorical variants. A *P-value* of < 0.05 was used as the cut-off level for significance. All demographic and behavioral risk factors with *p-values* less than 0.2 in univariate analysis were included in the "first" logistic regression model.

3. RESULTS

Out of 1610 blood donors, the male-to-female (M:F) ratio was 2:1 (1048 males, 562 females). The ages of the participants ranged from 18 to 54 years. The plasma samples were analyzed for HBsAg, Of the 1610 samples. The overall seroprevalence of HBV was 5.5% (95% CI: 4.36%– 6.58%) ranging from 0.06% (95% CI: 0-0.18) (HCV) to 0.12% (95% CI: 0-0.30) (Syphilis), men had a statistically significant higher prevalence of overt HBV infection than women (*P=0.0001*). The HBV- HIV co-infection was not observed (Table 1). The pattern of age-specific HBsAg prevalence is shown in Fig. 1. HBV infections were found in all age groups (Fig. 1). The age group most infected with HBV was 20–29 years old. The prevalence of HBsAg was lowest in the youngest age group (1%).

Table 1. Prevalence of HBV and co-infection among blood donors by sex

	No. Positive (%)		Ratio	Total (%)
	Male	**Female**	**M:F**	**No. Positive (%)**
Prevalence of HBV infection	75 (85.2%)	13 (14.8%)	(5.8 :1)	88 (5.5%)
Co-infection of HBV/HCV	1 (100%)	0 (0%)	(1 :0)	1 (0.06%)
Co-infection of HBV/Syphilis	2 (100%)	0 (0%)	(2 :0)	2 (0.12%)
Co-infection of HBV/HIV	0	0		

%: Percentage

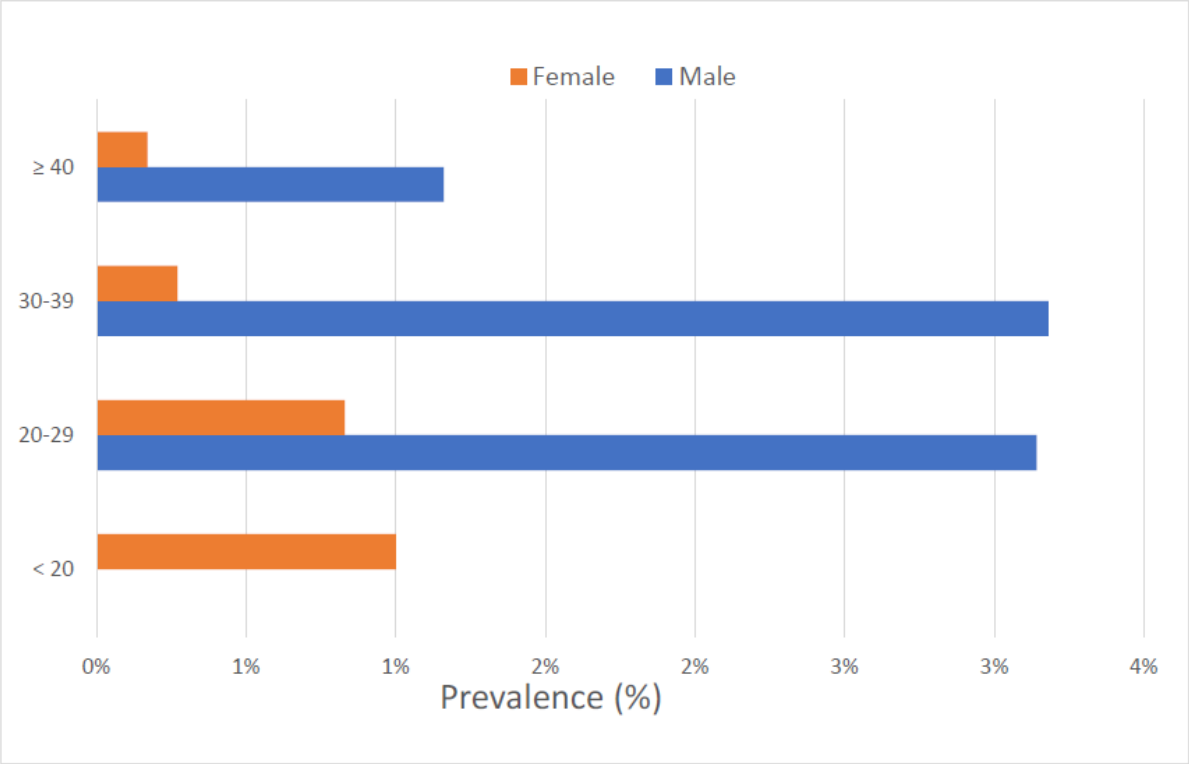

Fig. 1. Seroprevalence of hepatitis B infections by sex and age group, Gabonese National Blood Transfusion Centre, 2020

Table 2. Risk factors associated with HBV positivity

Variables	Univariate analysis		Multivariate analysis	
	Crude OR, CI95%	P-value	aOR, CI95%	P-value
Age (20-29 vs 30-49)	1 [0.97-1.04]	0.71		-
Male gender	1.82 [0.89-3.71]	0.1	2.5 [1.14-5.58]	0.02
First-time donor status	10.6 [5.25-21.42]	0.00001	11.06 [5.34-22.9]	0.01
Residence*	3.89 [1.88-8.08]	0.0003	2.52 [1.09-5.83]	0.03
Less than graduate	1.69 [0.98-2.92]	0.06	1.6 [0.85-2.99]	0.15
Blood exposure°	3.01[0.19-48.83]	0.44	-	-
Non-vaccination for HBV	0.88 [0.47-1.64]	0.68	-	-

**Residence (Outside Libreville vs Libreville); OR: Odds ratio with 95% confidence Intervals. Bold/italic was used for significant (P < .05) results; aOR: Adjusted odds ratios; °Blood exposure: defined as contact in one of the following categories: percutaneous, mucous membrane contact with blood of an individual*

3.1 Risk Factors of HBV Infection

Among 283 blood donors, a total of 71 HBsAg positive blood donors (60 new donors and 11 repeat donors) and 212 HBs Ag negative blood donors were included in the study. Table 2, shows the unadjusted odds ratios and adjusted odds ratios (aOR) and 95 percent confidence intervals (95% CI's). In the final multivariate model, first-time donor status was strongly associated to overt HBV infection (OR = 11.06, (95% CI 5.34-22.9), P= 0.01) (Table 2).

4. DISCUSSION

"Blood transfusion safety in sub-Saharan Africa (SSA) is marred by the high prevalence of infectious agents, chronic blood shortage and lack of resources. The WHO encourages blood donation from voluntary donors because this kind of donation believed to have lesser chance harboring and transmitting TTIs" [1].

In ASS such as Gabon, data on co-infection of Transfusion Transmissible Infection Agent (TTIA) is lacking, and the influence of geographic variability, ethnicity and socioeconomic factors on these infections has not been studied in urban areas. Studies on the sero-prevalence of HBV co- infection and the associated risk factors are needed.

The overall seroprevalence of HBV infections in this study was 5.5%, which was similar to previous studies conducted in Gabon [14,11]. "Our findings contrasted with those reported by Groc et al. who showed intermediate seroprevalence of HBV in general population" [10]. The situation described concerning HBsAg seropositivity among blood donors at the Gabonese NBTC would rather indicate a positive impact of measures to control this infection in the general population and not the effectiveness of the conventional blood safety strategy. This rate was also reported in other African countries [15,16,17,18].

"We found that HBV, HCV, Syphilis and co-infection are not common in Gabon. HBV co-infection seroprevalence was highest among male gender. In particular, it is interesting to note that cases of HCV and Syphilis were more common among the younger and older age. HBV/HCV or HBV/Syphilis infection seroprevalence decreased with the age groups of the donors. In the case of syphilis, this may represent a proportion of undisclosed infections given the existing stigma associated with syphilis. While transmission of HCV through injecting drug use is an underappreciated problem" [19], and "since it is considered a taboo practice, it is also likely to be undisclosed. HBV exposure with HCV infection and syphilis, suggesting that the ongoing HBV transmission in adulthood could be sexual, as has been reported in some other African countries" [20,21,22]. HBV/HCV and HBV/Syphilis profile rates were similar to the studies conducted in Equatoriale Guinea [23].

"Although our results also showed increased HBsAg seropositivity with age, the peak prevalence was observed in the older age group. Increased overt HBV infection among the adult population has also been reported among blood donors in Gabon" [14,11]. This observation was also reported in other African countries [23,24] in adulthood, suggesting ongoing adult transmission associated with a low prevalence of chronic HBV.

Global variation in the spectrum of HBV-related disease is substantial in part due to variation in the modes of transmission and natural history of

infection. Regarding demographic and behavioral factors, several factors have been associated. Male gender (aOR= 2.5 (95% CI: 1.14-5.58), *P=0.02*), First-time donor status (aOR= 11.06 (95% CI: 5.34-22.9), *P=0.01*) and residence (outside Libreville vs Libreville) (aOR= 2.52 (95% CI: 1.09-5.83), *P= 0.03*) were associated with HBsAg seropositivity. In our study, we found that gender male had than 2.5 times the odds of being HBsAg positive than gender female while adjusting for other factors, but it was similar to the finding reported among Gabonese blood donors in 2018 [11]. "Volunteer blood donors, in particular the young volunteers representative of the demography currently recruited to replace family replacement donors in Gabon, are a self-selected healthy group of people who were screened for the potential risk factors such as homosexuality, intravenous drug abuse, history of diabetes and presence of several sexual partners" [25]. "These behavioral risks were not associated with overt HBV infection in this study because the subjects were excluded from donation some donors may conceal exposure to high risk factors in the questionnaire. Male gender, first-time donor status and residence are the major transmission factors of HBV infection in our study and remain similar compared to the studies done by previous studies conducted in African countries" [26,27].

Our study had some limitations. This study was cross-sectionally designed, and detection of HBV was based on the HBVsAg marker without considering IgM and IgG antibodies to the core protein ideal for a complete diagnosis of infection stages. Thus, hepatitis B seroprevalence may be underestimated or overestimated in the population when using the HBsAg positive rate as the prevalence of chronic HBV infection. Additionally, the sample size was limited, and the study period was seemingly short. A more precise classification of risk factors in the questionnaire could be assessed in later studies, along with more potential factors, such as urban and rural blood banks.

5. CONCLUSION

This present survey report gives clear insights into the epidemiological status of HBV and co-infection. The important demographic and behavioral factors were male gender, first-time donor status and residence. Conventional approaches to assure blood product safety through donor questioning and laboratory screening have been highly effective for controlling risks from the major blood transmissible diseases. These provide useful information in the development of individual pre-donation questionnaires to deter those at risk from donating blood. Our study highlights that the main blood transfusion centre in Gabon is firmly reliant on safe blood donors, which is in line with the existing blood transfusion practice in the majority of countries in SSA.

CONSENT AND ETHICAL APPROVAL

Informed consent was taken from donors and controls and ethical clearance was taken from the Gabonese National Ethical Committee for research (authorization n° 0088/2019/PR/SG/CNER). The study was explained to each participant, and a written informed consent was obtained before enrollment to the study. Participants who were found to be seropositive for hepatitis B virus were channeled to the appropriate clinics for further evaluation and management.

AVAILABILITY OF DATA AND MATERIALS

Data used for this study is available on request.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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