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Study of the Prevalence of Hepatitis B and Associated Risk Factors in Cotonou (Benin) and Dakar (Senegal)

Comlan Jerome Gaston Montcho[1,2], Pelagie Mougola Bissiengou[1], Léopold Ngor Sene[1], Khadidiatou Sarr Fall[2], Ousseynou Boye[2], Moustapha Mbow[1], Babacar Mbengue[1], Alioune Dieye[1], Maguette Sylla Niang[1,2]

[1]Immunology Department, Faculty of Medicine, Pharmacy and Odontology, Cheikh Anta Diop University of Dakar, Dakar, Senegal
[2]Medical Biology Laboratory of the General Hospital Idrissa Pouye, Dakar, Senegal
Email: comlanjeromegasrton.montcho@ucad.edu.sn

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Abstract

Background: In 2019, the WHO estimated that over 296 million people were living with chronic hepatitis B virus (HBV) infection and over 820,000 deaths attributable to hepatitis B. Most people living with HBV are unaware of their immune status and live in endemic areas. This is the case of Benin and Senegal, which have little data on the disease. **Objective:** This study aimed to provide epidemiological furthers on hepatitis B in Dakar and Cotonou according to WHO recommendations about "obtaining data for action". **Materials and Methods:** Our study took place at the Medical Biology Laboratory of the Idrissa Pouye General Hospital (LBM-HOGIP) in Dakar, Senegal. Participants were selected at the LBM-HOGIP of Dakar or at the LBMs of the health centres of the Archdiocese of Cotonou respectively from November to December 2019 and February to March 2020. All participants were tested for hepatitis B virus antigen (HBsAg) using a microparticle chemiluminescence immunoassay assay. Other risk factors including blood transfusion, haemodialysis, tattooing, cultural or clan scarification, piercing, injecting drug use, unprotected sex and surgical procedures were also investigated. Informed consent was obtained from each participant. The study was approved by the ethics committees in Senegal and Benin. For the biological tests, Excel and IBM SPSS Statistics software were used for the analysis of the results. **Results:** A total of 470 participants were recruited including 234 in Cotonou and 236 in Dakar. The median age in Cotonou was 29 years with extremes of 10 and 65 years, and 38 years in Dakar with extremes of 6 and 93 years. The prevalence of HBsAg was 12.39% in Cotonou and 19.91% in Dakar. The most affected age groups were 20 - 29 in

Dakar and 30 - 39 in Cotonou. Except for piercing, none of the other risk factors considered in our study were found to be associated with HBV transmission in our populations. **Conclusion:** Our study is hospital-based and revealed high prevalence of HBsAg. These prevalences were higher in men.

Keywords

HBsAg, Seroprevalence, Risk Factors, Benin, Senegal

1. Introduction

Hepatitis B is an infection with the hepatitis B virus (HBV) that can attack the liver [1]. With more than 296 million people living with chronic HBV infection and more than 820,000 deaths in 2019 worldwide, hepatitis B requires an urgent global health response, especially in endemic countries [2]. In addition, most people living with hepatitis B virus (HBV) are unaware of their serology status although living in highly endemic areas where access to care is limited [1].

The highest prevalence of hepatitis B is found in sub-Saharan Africa [3] [4] although sub-Saharan African countries have little data on hepatitis B in the general population. This is the case in Senegal and Benin where the available data are often fragmentary. Therefore, investigations are needed in blood donors, pregnant women, haemodialysis patients, certain risk groups such as sex workers and injecting drug users [5]. However, a national prevalence in Benin has recently found in a nationwide study a prevalence of 6% in 2019 [6]. In Senegal, the national prevalence was estimated at 11% by the National Hepatitis Control Programme in 2018 [7]. In highly endemic countries, HBV is usually transmitted vertically from mother to newborn at birth, and also horizontally to contacts living in the vicinity of infected individuals, particularly during the perinatal period [8]. Studies have addressed some risk factors in isolation in groups of interest. Tattoos, blood transfusions, scarifications, piercing, university level education and sexual exposure have been reported as factors associated with HBV transmission in populations in the West African sub-region [9]-[14]. Viral hepatitis B is a major public health problem.

The assessment of HBsAg seroprevalence and the exploration of risk factors associated with infection in Dakar and Cotonou are in line with WHO recommendations on "obtaining data for action" and will contribute to providing new data on the epidemic. The overall objective of this study was to determine the seroprevalence of hepatitis B and to explore risk factors in our two populations through the testing of HBsAg.

2. Materials and Methods

2.1. Population and Study Setting

Hepatitis B is a life-threatening liver infection caused by the hepatitis B virus (HBV). This is a major public health problem. HBV can also cause chronic in-

fections and carries a significant risk of death from cirrhosis or liver cancer for those exposed.

This was a prospective epidemiological study on a cohort of patients. Study population has been selected from patients coming to the Medical Biology Laboratory of the General Hospital Idrissa Pouye (LBM-HOGIP) in Dakar (Senegal) and at the medical biology laboratories of the health centres of the Archdiocese of Cotonou (Benin). These patients underwent Hepatitis B test from their clinician. It took place from November to December 2019 in Dakar and February to March 2020 in Cotonou. All sample processing were performed at LBM-HOGIP in Dakar in order to use the same platform to perform all tests.

The recruitment of participants took place in three phases: first, the reception of all the patients met in the medical biology laboratories for a general presentation of the object of the research; then the individual reception of the interested patients for a detailed presentation of the steps of the research in order to obtain their consent; finally, the collection of the socio-demographic data of each patient by means of a questionnaire and the collection of venous blood on a dry tube. The criteria for selection of subjects were presence at the recruitment sites for any biological blood test without distinction of sex or age.

People already undergoing treatment for chronic HBV infection, those who had already been fully vaccinated as well as people who did not provide informed consent were excluded from this study.

2.2. Ethical Considerations

This study received ethical approval from the Research Ethics Committee (CER) of the University Cheikh Anta Diop (UCAD) of Dakar (Nr 041012019/CER/UCAD) and from the National Ethics Committee for Health Research (CNERS) of Benin (Nr 48/November 2019). Throughout the course of the study, the commitments made to the various ethics committees regarding the collection of data to the publication of the results were respected. In accordance with the recommendations of the ethics committees, the consents of minors were provided by their parent or legal guardian.

2.3. Data Collection

Data from each participant was collected through a questionnaire during an individual meeting. Data collected included certain socio-demographic characteristics such as first name, last name, sex, age, marital status, occupation, education level, and also family history of hepatitis B, *i.e.* jaundice or a history of hepatitis in the family circle. Risk factors like blood transfusions, haemodialysis, tattoos, cultural or clan scarification, piercing, injection drug use, unprotected sex, and surgical procedures were also considered. Data for each study population was collected in Excel Office 365.

2.4. Determination of Hepatitis B Virus Antigen (HBsAg)

Serological testing for HBsAg was based on a microparticlechemiluminescence

immunoassay using Architect CI4100 (Abbott Diagnostics, USA). It is adapted on an integrated automated platform allowing clinical chemistry and immunology tests to be performed. Calibrations were performed, validated and stored in the system prior to analysis of internal quality controls and test samples.

2.5. Statistical Analysis of the Data

Statistical analysis of the data was performed using Excel Office 365 and IBM SPSS Statistics version 20 from which we described and analysed the variables such as percentage, mean and standard deviation, median, and Odd Ratio. Quantitative variables are presented as mean or median values with their dispersion index. Chi-square tests, analysis of variance, unpaired Student's t-tests, or non-parametric tests (Mann-Withney, Spearman) were used to compare HBsAg, patient characteristics including epidemiological data (age, sex, etc.) and risk factors between groups. In all analyses, a threshold value of $p < 0.05$ was considered statistically significant.

3. Results

Overall, a total of 470 participants were recruited, including, 234 participants in Cotonou and 236 in Dakar.

3.1. Socio-Demographic Characteristics of the Study Population

Considering the age of the different groups recruited in our study, we found that in Cotonou, the median age was 29 years with extremes of 10 years and 65 years. The most represented age group was 20 to 29 years regardless the gender. In Dakar, the median age was 38 years with extremes of 6 and 93 years; the most represented age group was 30 to 39 years for both sexes. However, there was no significant difference between the two sub-populations for the age distribution ($p = 0.46$) and for the sex.

Regarding the education levels, we found 2.99% (N = 7) and 21.18% (N = 50) of illiterates in Cotonou and Dakar respectively (**Table 1**).

3.2. Prevalence of HBsAg

In Cotonou, 29 patients were positive for HBsAg, *i.e.* a prevalence of 12.39%. This prevalence varied according to age ranges as followed: 31.03% (N = 9) for 20 - 29 years old, 41.37% (N = 12) for 30 - 39 years old, 13.8% (N = 4) for 40 - 49 years old, and 50 - 58 years old (**Figure 1**).

In Dakar, 47 patients were positive for HBs antigen, *i.e.* a prevalence of 19.91%. This prevalence also varied according to age range: 2.13% (N = 1) for 10 - 19 and 70 - 79 years old, 29.78% (N = 14) for 20 - 29 years old, 27.66% (N = 13) for 30 - 39 years old, 17.02% (N = 8) for 40 - 49 years old, 10.64% (N = 5) for 50 - 59 years old, and 60 - 69 years old (**Figure 2**).

In Cotonou, 62.1% of infected people (N = 18) were male compared to 66% of males (N = 31) in the Dakar study. We did not find any significant difference in

Table 1. Main socio-demographic characteristics of the study population.

Variables	Population recruited in Cotonou					Population recruited in Dakar				
	Men		Womens		Total	Men		Women		Total
	N	% (CI) 95%	N	% (CI) 95%	N	N	% (CI) 95%	N	% (CI) 95%	N
Age group										
0 - 9 years	0	0	0	0	0	0	0	1	0.8 [−0.06; 0.08]	1
10 - 19 years	0	0	10	4.3 [−0.3; 0.11]	10	7	6.2 [−0.08; 0.13]	9	7.3 [0; 0.14]	16
20 - 29 years	38	16.2 [0.9; 0.23]	71	30.3 [0.23; 0.37]	109	18	16.1 [0.09; 23]	29	23.4 [0.16; 0.30]	47
30 - 39 years	24	10.3 [0.03; 0.17	44	18.8 [0.12; 0.26]	68	28	25 [0.18; 0.32]	33	26.6 [0.19; 0.33]	61
40 - 49 years	14	6 [−0.01; 0.13]	10	4.3 [−0.3; 0.11]	24	21	18.8 [12; 0.26]	17	13.7 [0.06; 0.20]	38
50 - 59 years	10	4.3 [−0.03; 0.11]	7	3 [−0.04; 0.1]	17	11	9.8 [−0.03; 0.17]	15	12.1 [0.05; 0.19]	26
60 - 69 years	3	1.3 [−0.06; 0.08]	3	1.3 [−0.06; 0.08]	6	17	15.2 [0.82; 0.22]	11	8.9 [0.92; 0.16]	28
70 - 79 years	0	0	0	0	0	7	6.2 [0; 0.14]	6	4.8 [−0.02; 0.12]	13
80 - 89 years	0	0	0	0	0	3	2.7 [0.04; 0.09]	2	1.6 [−0.05; 0.09]	5
>90 years	0	0	0	0	0	1	0.8 [−0.06; 0.78]	0	0	1
Total	89	38 [0.31; 0.45]	145	62 [0.55; 0.69]	234	112	47.46 [0.40; 0.54]	124	52.54 [0.45; 0.59]	236
Sex										
Femal	145	62 [0.55; 0.69]				124	52.54 [0.45; 0.59]			
Male	89	38 [0.31; 0.45]				112	47.46 [0.40; 0.54]			
Marital status										
Single	21	43.8 [0.36; 0.5]	27	56.2 [0.53; 0.60]	48	37	67.3 [0.60; 0.74]	18	32.7 [0.26; 0.4]	55
Married	67	37.2 [0.30; 0.44]	113	62.8 [0.56; 0.70]	180	75	44.1 [0.37; 0.51]	95	55.9 [0.49; 0.63]	170
Widow/Wedowed	1	16.7 [0.09; 0.24]	5	83.3 [0.76; 0.90]	6	0	0	11	100 [0.93; 1.07]	11
Level of education										
No education	0	0	7	100 [0.93; 1.07]	7	16	32 [0.25; 0.39]	34	68 [0.61; 0.75]	50
Primary	4	21.1 [0.07; 0.28]	15	78.9 [0.72; 0.86]	19	21	61.8 [0.55; 0.69]	13	38.2 [0.31; 0.45]	34
secondary	49	36 [0.36; 0.43]	87	64 [0.57; 0.71]	136	38	45.8 [0.39; 0.53]	45	54.2 [0.47; 0.61]	83
University	36	50 [0.50; 0.57]	36	50 [0.43; 0.57]	72	37	53.6 [0.46; 0.61]	32	46.4 [0.39; 0.53]	69

Legend: N = Number, CI = Confidence Interval, % = Percentage.

HBV infection between the two sexes in the population recruited in Cotonou (p = 0.05). However, in Dakar, the difference in HBsAg prevalence was significantly higher in males (p = 0.04), (Figure 3). The prevalence of HBsAg was significantly higher in Dakar than in Cotonou (OR = 1.758; 95% CI [1.063; 2.908], p = 0.027), (Figure 4).

3.3. Risk Factors for Hepatitis B

Some risk factors for HBV infection including history of blood transfusion, occurrence of hepatitis B in the family, haemodialysis, piercing, tattoos, scarification,

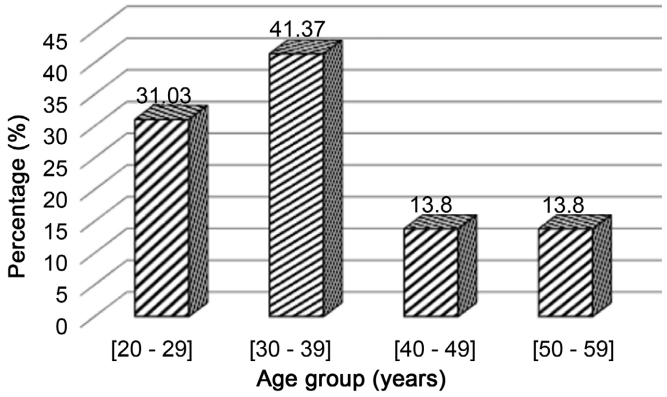

Figure 1. HBsAg prevalence by age group in the population living in Cotonou.
Legend: The age group with the highest HBsAg prevalence is 30 - 39 years.

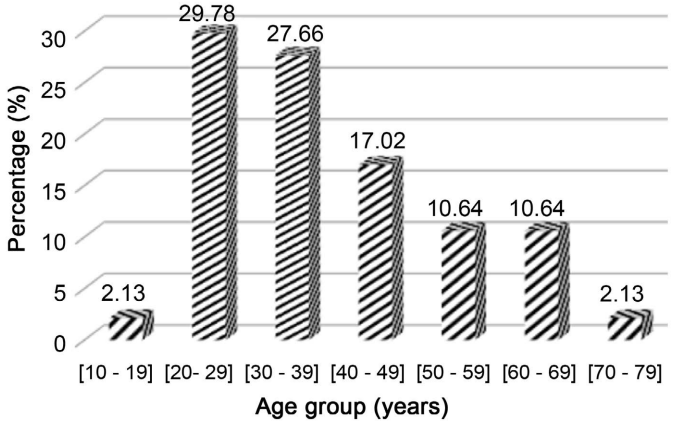

Figure 2. HBsAg prevalence by age group in the population recruited in Dakar.
Legend: The age group with the highest HBsAg prevalence is 20 - 29 years.

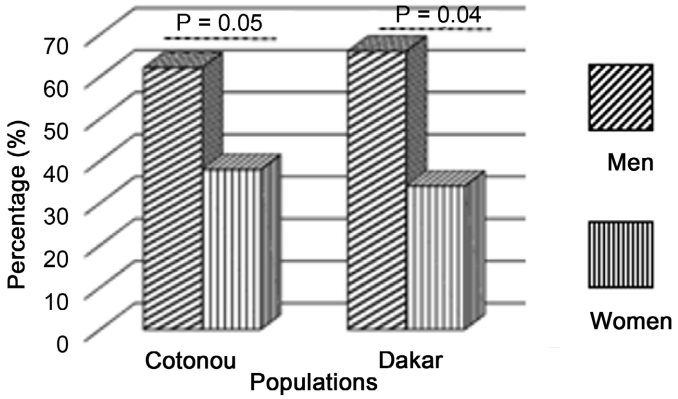

Figure 3. HBsAg prevalence by sex and population.
Legend: The prevalence of HBsAg is significantly higher in males in the study conducted in Dakar. In the population recruited in Cotonou, the difference in HBsAg prevalence by sex is not significant.

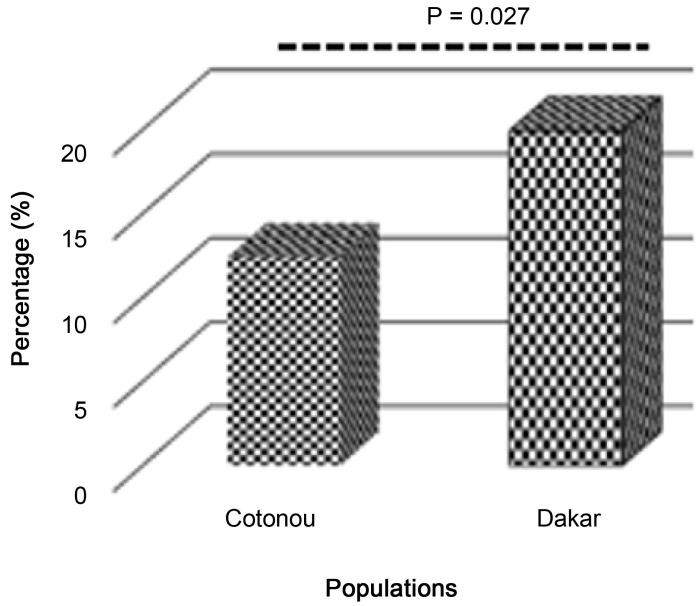

Figure 4. HBsAg prevalence by study population.
Legend: The difference in HBsAg prevalence between Benin and Senegal is significant: The risk of contracting HBV appears to be higher in Senegal than in Benin.

and history of surgery were addressed in our study. Apart from piercing (p = 0.002), none of the risk factors considered had a significant impact on HBV contamination (Table 2).

Table 2. Assessment of risk factors for hepatitis B infection.

Variables	Population recruited in Cotonou			Population recruited in Dakar		
	N	%	p-value	N	%	p-value
Blood transfusions						
Yes	22	9.4	0.38	14	4.9	0.12
No	212	90.6		222	94.1	
Hepatitis B in the family environment						
Yes	2	0.9	1.00	22	9.3	0.62
No	232	99.1		214	90.7	
Haemodialysis						
Yes	0	0	1.00	1	0.4	1.00
No	234	100		235	99.9	
Piercing						
Yes	130	55.6	0.041	127	53.8	**0.002**
No	104	44.4		109	46.2	
Tattoos						

Continued

Yes	27	11.5	0.99	7	3	0.70
No	207	88.5		229	97	
Scarifications						
Yes	79	33.8	0.35	74	31.4	054
No	155	66.2		162	68.6	
Injecting drugs						
Yes	0	0	1.00	0	0	1.00
No	234	100		236	100	
Health care worker						
Yes	9	3.8	0.94	18	7.6	0.33
No	225	96.2		218	92.4	
Condom use						
Yes	5	2.1	0.48	15	6.4	0.74
No	229	97.9		221	93.6	
Surgical procedures						
Yes	60	25.6	0.79	50	21.2	0.23
No	174	74.4		186	78.8	

Legend: N = Number, % = Percentage.

4. Discussion

We here conducted a prospective study with an analytical and descriptive aim and the administration of a questionnaire because this approach allows us to meet the subjects in order to collect their individual consent as required by the ethics committees in Senegal and Benin. In addition, personalised meetings with the participants were necessary to collect information relating to socio-demographic data and risk factors for HBV contamination. From samples collected, the chemiluminescence analytical technique was chosen in preference to ELISA and other methods because of its efficiency according to the work of Laouina *et al.* in 2016 [15].

Our study showed a predominance of women in study groups from both countries with 62% women and 38% men in Cotonou while in the population recruited in Dakar, we found 52.54% women and 47.46% men. The predominance of women is more pronounced in the population recruited in Cotonou than Dakar. This could be explained by the fact that women generally attend health facilities more than men, as reported in some hospital studies, including those conducted by Ahmed Ben *et al.* on the demand for care in general medicine in Tunisia in 2004 [16]. In another study conducted by Soliman *et al.* in 2016 on mass screening for hepatitis B and C in southern Egypt, women represented up to 52.3% of the population [17]. Such a female predominance was also reported in work conducted by Tadongfack T. *et al.* on the seroprevalence of hepatitis B

and associated risk factors in rural Cameroon in 2020, reporting 62.61% women [18].

With regard to HBsAg carriage, the population recruited in Cotonou showed a prevalence of 12.39% (n = 29) of which 62.07% were male (n = 18). This prevalence classifies our study population among endemic areas [19]. The prevalence in Cotonou was significantly higher than the prevalence of hepatitis B found at the national level by Kpossou A. *et al.* in 2019 which was 6% [6]. The prevalence of hepatitis B found in our study was also relatively higher than those reported by Kodjoh N. *et al.* as epidemiological indicators for viral hepatitis B some years earlier in 2014. According to these epidemiological indicators, the prevalences of viral hepatitis B among blood donors were 9.9%, 11.21% among people living with HIV, and 5.47% among infants in 2013 [5].

In the study population recruited in Dakar, the prevalence of HBsAg was 19.91%, (n = 47) of which 65% were male (n = 31). This prevalence was higher than those reported in most studies of populations of interest in Senegal. The prevalence of HBsAg was 1.1% in children under 16 years of age according to the work of Gora L. *et al.* in three children's hospitals in the Dakar region [20]. It was 14.2% in Senegalese soldiers sent to United Nations mission to Darfur according to the work of Diop *et al.* in 2017 and 12% in pregnant women in a study conducted by Niang S. M. *et al.* in 2017 in Dakar [20] [21].

The higher HBsAg prevalences in Cotonou and Dakar could be explained by our study site consisted of hospital setting. The hospitals where we recruited our populations indeed have a gastroenterology unit which could have favored the attendance of patients suspected of carrying a liver disease including hepatitis B [22]. However, these prevalences confirm that Dakar and Cotonou still remain in the category of viral hepatitis B endemic areas define as prevalence rates higher than 8% according to the work of Maclachlan *et al.* in 2015 related to the epidemiology of viral hepatitis B in the world [1] [19].

Our study had further shown a significantly higher prevalence of HBsAg in men than in women ($p < 0.001$). This has also been reported in previous studies in Thailand according to the work of Hongjaisee *et al.* in 2020 on the prevalence of viral hepatitis B and associated risk factors [23]. To our knowledge, the higher prevalence of viral hepatitis B among men in the West African sub-region was noted by Kpossou A. *et al.* in Benin in a study for the determination of a national prevalence of hepatitis B in 2018 [6]. The higher prevalence of hepatitis B in men is indeed constantly described in studies such as those conducted in Togo by Amivi T. *et al.* in 2018, in Guinea Bissau by Honge *et al.* in 2020, in Nigeria by Bakarey *et al.* in 2018 [24] [25] [26]. In fact, according to data from some previous research, the predominance of hepatitis B prevalence in men is due to a genetic factor that would more protect women against the virus [27].

The main limitation of this study was the fact that many risk factors for HBV transmission were explored but in a general approach without having deepened any of them. In addition, the hospital setting would constitute a bias in recruitment so that the prevalences of HBsAg found in our populations could not be

generalized to the entire population.

5. Conclusion

The high HBsAg prevalence in our study highlights the fact that Benin and Senegal remain countries of high endemicity of viral hepatitis B. The actions of the various national programmes to combat viral hepatitis must be maintained and strengthened to curb the spread of the hepatitis B virus in order to achieve the sustainable development objectives related to the reduction of the hepatitis B incidence rate. Measure of the National Hepatitis Control Programmes should also include reduction of the cost of the HBV vaccine which currently exceeds the guaranteed minimum wage in terms of daily earnings in the countries concerned.

Conflicts of Interest

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

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