

Prevalence of hepatitis B virus among pregnant women in the southern district of N'Djamena and strategies to prevent mother-to-child transmission

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Abstract

Hepatitis B remains a major public health concern in Sub-Saharan Africa, with a high risk of mother-to-child transmission. The objective of this study was to estimate the prevalence of hepatitis B surface antigen (HBsAg) among pregnant women in the southern district of N'Djamena and to document neonatal vaccination coverage within 24 hours. A descriptive cross-sectional study was conducted in five health facilities from December 2023 to December 2024. HBsAg screening was performed using an immunochromatographic test (manufacturer's standard procedure) and confirmed in the laboratory. Among 4,876 participants, 520 were HBsAg-positive (prevalence: 10.66%), with a mean age of 25.17 years, and 35.37% of the participants were illiterate. Out of 289 births from HBsAg+ mothers, 77.85% (n=225) of newborns received the vaccine dose within 24 hours. Inter-facility variations were observed. The observed prevalence confirms high endemicity in the southern district of N'Djamena, as well as a high acceptance of the vaccine at birth. These preliminary results support the implementation of an integrated policy: systematic screening during pregnancy, universal birth-dose vaccination, and community awareness campaigns.

Introduction

Hepatitis B in pregnant women remains a concerning public health issue in several regions of the world.¹ Maternal-fetal transmission of hepatitis B virus (HBV) constitutes a major route of contamination in highly endemic countries, particularly in Sub-Saharan Africa.² Indeed, mother-to-child transmission of the virus exposes the newborn to chronic forms in more than 90% of cases, with a high risk of complications,³ and 1 in 4 are at risk of premature death due to liver disease.⁴ Transmission occurs primarily during delivery, especially when the mother has a high viral load. In utero transmission is rare, but infection can also occur through close contact between the mother and infant, particularly during breastfeeding.³ All infants should receive one dose of hepatitis B vaccine within 24 hours of birth. This dose should be followed by two or three additional doses during the first year of life to achieve the target of ≥90% coverage of the birth dose by 2030.⁵ In 2019, Africa had the highest prevalence of chronic hepatitis B among children under 5 years of age: 2.5% (compared to <1% recommended by the WHO). Of the 6 million children under 5 infected worldwide, 4.3 million live in Africa. In 2021, 14 out of 47 countries had introduced the dose at birth, and only 17% of newborns had received it

on time. In Africa, approximately 370,000 newborns are infected each year by their mothers.⁶ The WHO classifies Chad as a high-prevalence area for hepatitis B ($\geq 8\%$).² Among pregnant women, available data remain limited but concerning, with a prevalence of 7.2% in N'Djamena, suggesting a high risk of perinatal transmission. However, the prevention of HBV transmission remains one of the main ways to significantly reduce the risk of perinatal transmission and to curb the progression of chronic infection from the earliest years of life. Thus, a sero-epidemiological study was conducted in the southern district of N'Djamena (Chad) to screen pregnant women attending prenatal consultations during the first or second trimester of pregnancy. In this context, it becomes essential to document the situation in Chad, where data are still limited.^{7,8} This study aimed to estimate the prevalence of hepatitis B surface antigen (HBsAg) among pregnant women in the southern district of N'Djamena and to reduce mother-to-child transmission of HBV by vaccinating newborns of seropositive mothers.

Materials and Methods

Study design, duration, and setting

This was a descriptive cross-sectional study conducted from December 2023 to December 2024 in the southern district of N'Djamena (Chad). This district was selected due to the proximity of several peripheral health facilities, some of which have specialized units for the management of infectious diseases. The five sites included were: i) University Hospital Complex "Bon Samaritain" (CHU-BS); ii) Order of Malta Health Center; iii) Saint Mother Theresa of Calcutta Health Center; iv) Walia Community Health Center; and v) Notre Dame des Apôtres (NDA) Hospital.

Population and inclusion/exclusion criteria

The study focused on pregnant women in their first or second trimester who attended a prenatal consultation at one of five selected health facilities in the southern district of N'Djamena and who had provided their informed consent.

Sample size

The minimum required sample size was calculated using the

Lorentz formula:

$$n = [Z^2 \times P \times (1-P)] / m^2$$

where $Z=1.96$ (α risk of 5%), $P=0.07$ (expected prevalence of HBsAg estimated at 7% according to regional data),⁹ and $m=0.05$ (precision of 5%). The calculation yielded a minimum sample size of approximately 100 participants. In total, 4,876 pregnant women were included, far exceeding the minimum required, which strengthens the accuracy of the estimates.

Data collection and biological analyses

After obtaining informed consent from the patients, a standardized questionnaire was used to collect sociodemographic information. A venous blood sample was then collected. After centrifugation, serum samples were analyzed for the detection of HBsAg using the ABON™ HBsAg immunochromatographic test (Abbott, Chicago, IL, USA), a rapid qualitative test with a sensitivity $>99\%$ and a specificity of about 97%, according to the manufacturer. Analyses were performed in accordance with the manufacturer's instructions. Positive cases were confirmed using the Abbott Abon Biopharm analyzer (Abon Biopharm Co., Ltd., Hangzhou, China).

Statistical analysis

Data were entered and filtered in Microsoft Excel 2016, then imported and analyzed with SPSS software (version 25). The overall prevalence and those by health center were calculated with their 95% confidence intervals (CIs) using the Pearson method. The statistical significance threshold was set at $p < 0.05$.

Results

Sociodemographic characteristics

Between December 2023 and December 2024, a total of 4,876 pregnant women were screened in five health facilities of the southern district of N'Djamena. The mean age of participants was 25.17 years (range: 14-49 years). The majority were uneducated (35.37%), followed by those with secondary education (27.29%). Detailed characteristics are presented in Table 1.

Table 1. Sociodemographic characteristics.

Characteristics	Categories	Number (n)	Percentage (%)
Age	14-20	1240	25.43
	21-25	1560	31.99
	26-30	1236	25.34
	31-35	600	12.30
	36-40	216	4.42
	41-45	21	0.43
	≥ 46	3	0.06
Education level	No schooling	1725	35.37
	Primary	751	15.40
	Secondary	1331	27.29
	Higher	1069	21.92
HBV vaccination status	Yes	69	1.42
	No	4807	98.58
History of HBV screening	Yes	87	1.78
	No	4789	98.21

HBV, hepatitis B virus.

Overall prevalence of HBsAg

Among the 4,876 women screened, 520 tested positive for HBsAg, giving an overall prevalence of 10.66% (95% CI: 9.81-11.56). This rate confirms that the southern district of N'Djamena is a high-endemicity area according to WHO classification ($\geq 8\%$).

Prevalence by health facility

Data analysis shows that, out of a total of 4,876 pregnant women screened, 520 (10.66%) were carriers of HBsAg. Prevalence varied across health facilities, with the highest rates observed at NDA Hospital (12.82%) and CHU-BS (11.94%), followed by the Saint Mother Theresa Center (11.89%) and the Walia Community Health Center (11.79%) (Table 2).

Vaccination of newborns

Among the 520 HBsAg-positive mothers, 289 births were recorded, and 77.85% (225/289) of newborns received the first dose of hepatitis B vaccine within 24 hours after birth, in accordance with WHO recommendations. The proportion varied across facilities, with the highest observed at CHU-BS (38.41%), followed by NDA Hospital (21.80%) (Table 3).

Discussion

Out of a total of 4,876 pregnant women in the first or second trimester attending antenatal consultations in the five health facilities of the southern district of N'Djamena during the study period, no refusal for screening was recorded. All of them benefited from HBsAg screening, of which 520 tested positive, representing a prevalence of 10.66%. This result confirms WHO data, which place Chad among the countries with a high HBV endemicity (prevalence $\geq 8\%$) in the general population.²

However, local data specifically concerning pregnant women remain limited. For example, a study conducted among pregnant women attending the Guelendeng health district (Mayo-Kebbi East province) reported a prevalence of 13%,¹⁰ higher than that

found in our study. This difference could be explained by the fact that we included only women in the first or second trimester of pregnancy, a period during which attendance at health centers is lower, particularly during periods of intense heat (March-May), Ramadan, and year-end holidays.

Two studies were conducted in N'Djamena among pregnant women. The first, conducted in 2022 by Habkreo *et al.*, revealed a prevalence of 10.1% in a population of 266 pregnant women,⁷ suggesting a situation of high endemicity. The second, conducted in 2023 by Debsikréo *et al.* among 458 pregnant women in N'Djamena, showed a lower prevalence (7.2%, 95% CI: 5.0-9.9),⁸ corresponding to intermediate endemicity.

Our study found a prevalence of 10.66% among pregnant women, confirming previous findings that classify Chad as a highly endemic area and further highlighting the significant burden of infection in this population.^{7,8} These differences may be explained not only by the smaller sample sizes in the previous studies (266 and 458 women, respectively, compared to 4,876 in the present study), but also by differences in sociodemographic characteristics. Indeed, earlier studies primarily focused on women living in urban settings, likely with higher levels of education, whereas our study was conducted in rural and peri-urban areas, where the proportion of pregnant women with no formal education was considerably higher (35.37%). By comparison, in Benin, Khadidjatou *et al.* reported a prevalence of 14.02% among pregnant women,¹¹ while in Cameroon, Mawouma *et al.* observed a prevalence of 18.4%.¹² These higher prevalences corroborate WHO data, which indicate that these countries also belong to the high-endemicity zone for HBV ($>8\%$).² Furthermore, the prevalence found in our study is higher than those reported in several countries: Lomé (3%),¹³ Eritrea (3.2%),¹⁴ Egypt (5%),¹⁵ southern Ethiopia (7.3%),¹⁶ and Yaoundé, Cameroon.¹⁷ This difference may reflect Chad's delay in implementing national prevention strategies against HBV.

Our rate also exceeds the Sub-Saharan Africa regional average, estimated at 5.89%.¹⁸ It falls within the highest range observed in Central Africa, comparable to Cameroon and the Central African Republic.¹⁹ Inter-facility variations were noted: 12.83% at NDA, 11.94% at CHU-BS, 11.90% at Saint Mother Theresa, 11.80% at Walia Community Health Center, *versus* 7.68% at the Order of

Table 2. Prevalence of HBsAg carriage by health facility.

Health facilities	HBsAg- n (%)	HBsAg+ n (%)	95% CI
CHU-BS	1408 (88.06)	191 (11.94)	10.40-13.64
NDA	768 (87.18)	113 (12.83)	10.69-15.22
Order of Malta	1459 (92.46)	119 (7.68)	6.40-9.12
Saint Mother Theresa	422 (88.11)	57 (11.90)	9.14-15.14
Walia Community	299 (88.21)	40 (11.80)	8.56-15.72

HBsAg, hepatitis B surface antigen; CI, confidence interval; CHU-BS, University Hospital Complex "Bon Samaritain"; NDA, Notre Dame des Apôtres.

Table 3. Vaccination of newborns.

Health facilities	Registered births	Newborns vaccinated within 24 h, n (%)	Newborns not vaccinated, n (%)
CHU-BS	132 (45.67%)	111 (38.41%)	23 (7.95%)
NDA	72 (24.91%)	63 (21.80%)	9 (3.11%)
Order of Malta	59 (20.42%)	33 (11.42%)	26 (8.97%)
Saint Mother Theresa	14 (4.84%)	11 (3.81%)	3 (1.04%)
Walia Community	12 (4.15%)	7 (2.42%)	5 (1.73%)
Total	289 (100%)	225 (77.85%)	66 (22.84%)

CHU-BS, University Hospital Complex "Bon Samaritain"; NDA, Notre Dame des Apôtres.

Malta. These disparities may be related to differences in epidemiological profiles, access to care, or the origins of the patients. A more in-depth geo-epidemiological analysis would be needed to identify these determinants.

The mean age of participants was 25.17 years and the most represented age group was 21-25 years. These results are similar to those reported in Chad by Habkreo *et al.*,⁷ and in Cameroon by Mawouma *et al.* and Njoya *et al.*, with respective mean ages of 25.62±5.17, 25, and 24.54±6 years.^{12,20} Concordant data were also reported in Benin.¹¹

Regarding vaccination status and previous screening, 98.58% of women were not vaccinated against HBV and 98.21% had never undergone screening before this study. These results corroborate Ethiopian data from Gebreerkos, who showed that 85.87% of pregnant women had never been screened for HBV.²¹ This absence of prevention fosters active circulation of the virus and increases the risk of chronicity, knowing that more than 90% of newborns infected at birth develop chronic infection.³ Financial constraints, lack of effective national prevention strategies, and limited knowledge among health professionals involved may explain these gaps.

From an educational perspective, 35.37% of participants were uneducated and 27.29% had reached the secondary level. These results are close to those of Habkreo *et al.* in Chad,⁷ and of Khadidjatou *et al.* in Benin.¹¹ They reflect the low schooling rate among women in Chad, confirmed by the Demographic and Health Surveys and Multiple Indicator Cluster Surveys (DHS-MICS) data.²²

Finally, of the 4,876 pregnant women enrolled, 520 tested positive for HBsAg. Among these 520 seropositive women, 289 births were recorded, of which 225 newborns (77.85%) received the vaccine dose within 24 hours of birth, in accordance with WHO recommendations.² Our results indicate strong acceptance of vaccination by mothers within one day of birth, which may enhance the vaccine's effectiveness (currently under investigation), consistent with findings from other African studies.^{23,24}

These results highlight a high prevalence of HBV among pregnant women in the southern district of N'Djamena, associated with low education level, an almost total absence of vaccination, and lack of prior screening. They advocate for systematic and free HBsAg screening at the first antenatal consultation; universal newborn vaccination within 24 hours, including in peripheral areas; continuous training of health personnel in the prevention of mother-to-child transmission; community awareness campaigns; and access to antiviral prophylaxis for mothers with high viral loads.

Limitations of the study

This study has several limitations, including its preliminary nature, limited generalizability to only the southern district of N'Djamena, and the absence of HBV viral load measurements in HBsAg-positive women, which restricts an accurate assessment of the risk of vertical transmission. Effective HBV prevention requires sustainable funding, support from authorities, and community engagement. A pediatric follow-up protocol for vaccinated newborns is currently underway, including screening of breastfed children aged 13 to 18 months to assess their serological status, development, nutrition, and liver condition. Extending the study to other districts, with in-depth virological analysis and accurate mapping, will enable the development of an integrated national hepatitis B prevention policy, in line with the WHO's 2030 targets.

Conclusions

This pilot study highlights a high prevalence of HBsAg among pregnant women in the southern district of N'Djamena, confirming the high endemicity of this infection in Chad. The preliminary results of this study confirm the urgent need to strengthen prevention of mother-to-child transmissions of hepatitis B in Chad, emphasizing the importance of enhancing community awareness by encouraging systematic screening among pregnant women, as well as the establishment of a genuine national HBV prevention policy. In this context, newborn vaccination within 24 hours of birth, combined with vaccination of at-risk groups, constitutes an essential and effective strategy to significantly reduce the burden of the disease and contribute to better infection control in Chad.

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