World Journal of Advanced Research and Reviews
eISSN: 2581-9615 CODEN (USA): WJARAI
Cross Ref DOI: 10.30574/wjarr
Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

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Serological profile of Hepatitis B virus infection among children under five years of age followed at the mother and Child University Hospital (CHU-ME) of N'Djamena, Chad

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World Journal of Advanced Research and Reviews, 2025, 28(03), 760–764

Publication history: Received 30 October 2025; revised on 06 December 2025; accepted on 09 December 2025

Article DOI: https://doi.org/10.30574/wjarr.2025.28.3.4078

Abstract

Introduction: hepatitis B remains highly endemic in sub-Saharan Africa, where mother-to-child and early childhood horizontal transmission are predominant. This study aimed to determine the prevalence of hepatitis B virus (HBV) infection and describe the serological profile among children under five years of age.

Patients and Methods: a descriptive cross-sectional study was conducted from February to July 2024 at the Mother and Child University Hospital in N'Djamena. All children aged 0–59 months attending outpatient consultations or hospitalized were included after parental consent. Capillary blood samples were collected on dried blood spots (DBS) according to WHO recommendations. HBV markers (HBsAg, HBeAg, anti-HBc IgM, and anti-HBs) were analyzed using ELISA. Data analysis was descriptive.

Results: a total of 156 children were included. The mean age was 23.3 ± 15.4 months; 42.9% were between 0 and 12 months old. The sex ratio was 1.1. The prevalence of HBsAg was 1.28% (n = 2). One child showed concurrent positivity for HBeAg and anti-HBc IgM, indicating recent infection with active viral replication. No anti-HBs antibodies were detected. Overall vaccination coverage was 56.4%.

Conclusion: the low prevalence observed suggests a positive impact of routine childhood vaccination. However, the presence of active HBV infections among infants highlights the need to systematically introduce the hepatitis B birth dose in Chad.

Keywords: Hepatitis B; Prevalence; Children; Vaccination; Chad.

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1. Introduction

Hepatitis B virus (HBV) infection remains a major global public health concern, accounting for an estimated 887,000 deaths each year despite the availability of a safe and effective vaccine [1]. Worldwide, the prevalence of chronic HBV infection is estimated to range between 257 and 291 million individuals. To reduce this burden, the World Health Organization (WHO) adopted in 2016 a global elimination strategy targeting a 90% reduction in incidence and a 65% reduction in HBV-related mortality by 2030 [2,3].

Africa is one of the most heavily affected regions, with nearly 82 million people living with chronic hepatitis B [4]. In 2022, the regional prevalence of hepatitis B surface antigen (HBsAg) was estimated at 5.4%, including 1.7% among children under five years of age, corresponding to approximately 3.6 million cases [3]. This age group is particularly vulnerable: more than 90% of infected infants and up to 60% of young children progress to chronic infection [1]. Transmission occurs predominantly through vertical or early horizontal routes [5].

Vaccination remains the cornerstone of prevention. However, coverage of the hepatitis B birth dose (HepB-BD) remains low across Africa: by 2022, only 14 countries had introduced the vaccine, with timely administration in merely 14% of newborns [3,6]. This limited uptake contributes to the continued occurrence of new infections [2,4]. Furthermore, the proportion of children achieving protective antibody levels remains modest, around 57% [1].

In West Africa, HBsAg prevalence reaches 10.1% among blood donors and approximately 5% among children aged 0–16 years [4,6,7]. In Chad, the hepatitis B vaccine has been integrated into the Expanded Programme on Immunization (EPI) since 2008 [3]. A study conducted at the University Hospital of Mother and Child (CHU-ME) in N'Djamena reported an immunization rate of 76% and a mean anti-HBs antibody level of 118.9 mIU/mL among children aged 1 to 10 years [8].

Given the persistence of pediatric transmission, regional disparities, and the need to assess the impact of the national EPI, updated local data are essential. This study therefore aimed to determine the prevalence and serological profile of HBV infection among children under five years of age followed at CHU-ME in N'Djamena, in order to inform national strategies for HBV prevention and elimination.

2. Patients and Methods

This was a descriptive cross-sectional study conducted from February 1 to July 31, 2024, at the University Hospital of Mother and Child (CHU-ME) in N'Djamena. All children aged 0 to 59 months seen either in pediatric outpatient consultation or hospitalized during the study period were consecutively enrolled after parental consent was obtained. Children with incomplete records, invalid samples, or parental refusal were excluded.

The minimum required sample size was calculated using the Lorentz formula, based on an expected HBV prevalence of 10.8% among children under five years (WHO 2020), a 95% confidence level (Z = 1.96), and a 5% precision. The formula applied was:

$$N = (1.96)^2 \times 0.108\ (1 - 0.108) / (0.05)^2 = 148$$

Thus, the minimum sample size required was 148 children. In total, 156 children were ultimately included.

Blood sampling was performed by heel or finger prick, placing several drops on filter paper (Dried Blood Spot, DBS) according to WHO recommendations. Cards were dried, labeled, and transported to the Chantal Biya International Reference Centre (CIRCB) in Yaoundé for analysis.

Serological markers were assessed using ELISA and included hepatitis B surface antigen (HBsAg, indicating current infection), hepatitis B e antigen (HBeAg, reflecting active viral replication), anti-HBc IgM (recent infection), and anti-HBs antibodies (vaccine-induced or post-infection immunity).

Data were entered in Microsoft Excel 2021 and analyzed descriptively using frequencies, percentages, and means ± standard deviation. No inferential statistical analysis was conducted because of the small number of positive cases.

The study received ethical approval from the Dean of the Faculty of Human Health Sciences and authorization from CHU-ME. Informed consent was obtained from each parent or guardian, and strict confidentiality of all participant data was ensured.

3. Results

Of the 156 samples tested, two were positive for HBsAg, corresponding to a hepatitis B virus (HBV) seroprevalence of 1.28%. These results were confirmed using ELISA.

The mean age of the children was 23.3 ± 15.4 months (range: 1–48 months). The most represented age group was 0–12 months (42.9%, n=67), followed by 19–36 months (32.7%, n=51), 37–48 months (17.9%, n=28), and 13–18 months (6.4%, n=10). Both sexes were almost equally represented.

A total of 56.4% (n=88) of the children were vaccinated against HBV, whereas 43.6% (n=68) were unvaccinated. Ten children (6.4%) had a history of blood transfusion, while 93.6% (n=146) had never been transfused. Breastfeeding was reported in 89.7% (n=140) of the children, whereas 10.3% (n=16) had not been breastfed.

Table 1 Sociodemographic characteristics of the children

Variables	**n**	**%**
Mean age (months)	23.3 ± 15.4	—
Age groups (months)		
0–12	67	42.9
13–18	10	6.4
19–36	51	32.7
37–48	28	17.9
Sex		
Boys	77	49.4
Girls	79	50.6
HBV vaccination status		
Vaccinated	88	56.4
Unvaccinated	68	43.6
History of blood transfusion		
Yes	10	6.4
No	146	93.6
Breastfeeding		
Yes	140	89.7
No	16	10.3

Regarding the serological profile of the HBsAg-positive children, one child presented an acute infection profile (HBsAg+, HBeAg+, anti-HBc IgM+), with no evidence of protective immunity, as shown in Table 2.

Table 2 Expression of hepatitis B serological markers in HBsAg-positive children

Serological marker	Positive (n)	Negative (n)
HBsAg	2	0
HBeAg	1	1
Anti-HBc IgM	1	1
Anti-HBs	0	2

4. Discussion

The present study aimed to determine the seroprevalence of hepatitis B virus (HBV) infection and describe the serological profile among children under five years of age followed at CHU-ME in N'Djamena. Hepatitis B remains a major public health problem in sub-Saharan Africa, where mother-to-child transmission and early horizontal transmission are the predominant routes of infection in young children [9,10]. According to WHO estimates, Central and West Africa are among the regions with the highest endemicity, with an average pediatric prevalence of approximately 1.7% in children under five years of age [11].

In our study, the prevalence of HBsAg was 1.28%, a rate lower than the levels reported in the region. Higher prevalences have been documented in recent years: 2.9% in Nigeria, 2.1% in Ethiopia, 3.0% in Ghana, and 2.5% in Cameroon [12–15]. This difference may reflect a partial impact of Chad's Expanded Programme on Immunization (EPI), which has included the HBV vaccine since 2008. In our cohort, 56.4% of children were vaccinated—still below the ≥90% coverage target recommended to achieve HBV elimination [16].

However, the absence of a birth dose (HepB-BD) remains a major barrier to eliminating perinatal transmission. In Africa, only 14 countries have introduced this dose, and fewer than 14% of newborns receive it in a timely manner [1,11]. This gap likely contributes to early infections, as illustrated by the acute serological profile observed in one of our two HBsAg-positive children (HBsAg+, HBeAg+, anti-HBc IgM+), suggestive of perinatal or late-perinatal transmission [5].

The second HBsAg-positive child exhibited an HBeAg-negative and anti-HBs-negative profile, indicating an absence of protective immunity. Among children infected early in life, the lack of protective anti-HBs antibodies (<10 mIU/mL) suggests a high risk of chronicity, as 80–90% of infants infected before one year of age develop chronic HBV infection [2,9]. This finding indicates that HBV transmission remains active in Chad despite routine childhood immunization.

The vaccination rate observed in our study (56.4%) is consistent with recent national estimates, which reported a coverage of approximately 58% for the third dose (HepB3) in 2021 [8]. However, even among vaccinated children, seroprotection is not assured. A recent African meta-analysis found that only 57% of vaccinated children reach protective anti-HBs levels ≥10 mIU/mL [6]. In N'Djamena, Mayanna et al. reported a seroprotection rate of 76% among children aged 1–10 years, although antibody titers progressively declined with age [8].

Although relatively low (6.4%), the proportion of children with a history of blood transfusion remains a notable risk factor in high-endemicity settings, where transfusion safety can be inconsistent [7].

5. Conclusion

Hepatitis B virus continues to represent a significant public health challenge in Chad, despite its inclusion in the national immunization program. Achieving the WHO elimination targets will require widespread population-level screening coupled with systematic administration of the hepatitis B birth dose.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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