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Comprehensive Assessment of Hepatitis B Virus Infection: Seroprevalence, Gut Microbiota Interactions, and Pregnancy Outcomes

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Key words: Hepatitis B; Occult infection; Gut microbiota; Seroprevalence; TDF; Pregnancy; Vertical transmission

Abstract

Hepatitis B virus (HBV) continues to be a silent yet significant global health concern, especially in low-resource settings. In Libreville, Gabon, a review of screening records revealed that nearly 60 % of adults had been exposed to HBV, and about 22 % were actively infected—yet only about 15 % had ever been vaccinated. Among pregnant women, susceptibility to HBV was worryingly high, underscoring risks of vertical transmission. At the same time, in Guangzhou, China, our gut microbiome study showed that people with occult HBV infection had distinct microbial features—especially increased *Subdoligranulum* and decreased *Faecalibacterium*—which might reflect immune activation that keeps the virus suppressed.

Meanwhile, in southern Vietnam, over half of 375 pregnant women with chronic HBV received tenofovir disoproxil fumarate (TDF) during pregnancy, and their HBsAg levels correlated well with HBV DNA. These findings highlight the importance of combining epidemiological surveillance, microbiome insights, and accessible antiviral therapy to curtail HBV transmission and improve outcomes.

1. Introduction

Every year, HBV affects millions and tragically claims over 820,000 lives from liver-related complications [1]. Despite safe and effective vaccines, many people in regions such as sub-Saharan Africa and Southeast Asia remain at risk due to weak health infrastructure and limited resources.

Occult HBV infection (OBI)—where viral DNA is detectable despite a negative HBsAg result—complicates diagnosis and poses risks for transmission. Emerging evidence suggests gut bacteria might modulate the immune system and help keep HBV replication in check [2,3].

Pregnancy represents another critical twist in the HBV story. Without intervention, the virus can be passed from mother to child. Vietnam has implemented TDF therapy

during pregnancy to mitigate this, but better tools are needed to identify who benefits most [4].

This article brings together three strands of our research: HBV seroprevalence data from Gabon, gut microbiome insights from Hong Kong, and maternal antiviral therapy analysis from Vietnam—together offering a fuller picture of the HBV challenge.

2. Materials and Methods

2.1 Gabon Seroprevalence Study (2002–2022)

We retrospectively reviewed 496 individuals tested for all key HBV markers (HBsAg, anti-HBc, anti-HBs, anti-HBe, HBeAg) at the Libreville University virology lab [5]. Participants included healthcare workers, pregnant women, and adults referred by clinicians with complete sociodemographic records.

2.2 Gut Microbiota among OBI Cases in China (2021–2022)

We collected stool samples from 18 chronic HBV carriers, 24 OBI cases, and 20 healthy donors. Sequencing of the V3–V4 region of the 16S rRNA gene was performed, and microbial communities were compared using LEfSe analysis to identify taxa enriched in OBI [3].

2.3 Vietnam Maternal HBV Cohort (2019–2021)

We followed 375 pregnant women with chronic HBV at a tertiary clinic. HBsAg, qHBsAg (quantitative), HBV DNA, HBeAg, and liver enzymes were measured. Women with high viral loads or specific clinical indicators were offered TDF (300 mg daily) from late pregnancy through one month postpartum, alongside infant HBIG and vaccine [4].

3. Results

3.1 Seroprevalence in Libreville, Gabon

Among the 496 participants:

- **59.5 %** had anti-HBc, indicating past or current infection.
- **21.8 %** were HBsAg-positive, confirming active infection.
- **15.1 %** had vaccination-induced immunity.
- **25.4 %** had no detectable HBV markers, leaving them susceptible—especially pregnant women (Table 1).

Lower vaccination uptake among healthcare workers and high susceptibility in pregnant women were particularly concerning.

3.2 Microbiota Patterns in OBI Individuals

Our microbial analysis revealed a distinct signature in OBI cases compared to both chronic HBV carriers and healthy donors:

- **Reduced *Faecalibacterium***—a known anti-inflammatory genus.
- **Elevated *Subdoligranulum***—possibly linked to heightened immune responses.

These findings suggest gut bacteria may contribute to immune-mediated suppression of HBV replication in OBI (Table 2) [3,6].

3.3 Pregnancy Management and TDF Use in Vietnam

Out of 375 pregnant women:

- **208 (55.5 %)** received TDF treatment based on HBV DNA levels, HBeAg status, elevated liver enzymes, or family history of liver complications.
- Median age was 29 years (IQR 26–32).
- A **strong correlation** ($r = 0.81$) was observed between qHBsAg and HBV DNA levels, indicating qHBsAg can serve as a practical alternative when DNA testing is not accessible (Table 3) [4].

Table 1: HBV Marker status in gabon cohort.

Marker/Status	Number (n)	Percent (%)	Notes
HBsAg-positive	108	21.8	Most common in ages 16–35, especially HCWs
Anti-HBc positive	295	59.5	Indicates prior exposure
Anti-HBs positive only	75	15.1	Vaccinated immunity
No markers detectable	126	25.4	Susceptible individuals, many pregnant

Table 2. Gut bacterial shifts in obi cases.

Genus	Direction of Change in OBI	Potential Role
Faecalibacterium	Decreased	Anti-inflammatory, supports tolerance
Subdoligranulum	Increased	May activate Th17 and IFN-γ responses

Table 3: Antiviral Use & Biomarker Correlation in Pregnant Women.

Variable	TDF Recipients	Non-TDF Group
HBeAg Positive	96.1 %	61.1 %
qHBsAg ≤ 10^4 IU/mL	21.6 %	7.2 %
Median Age (IQR)	29 (26–32)	30 (27–33)
Correlation qHBsAg–HBV DNA	r = 0.81	r = 0.24

4. Discussion

4.1 Seroprevalence and Vaccination Gaps in Gabon

The high rates of exposure and infection among Gabonese adults underline a persistent public health threat. Despite this, fewer than one in five individuals had vaccine-derived immunity. The elevated infection risk among pregnant women and healthcare workers emphasizes the need for expanded immunization and routine screening programs [5].

4.2 The Microbiome Connection in OBI

The microbiota shifts observed in OBI suggest that gut bacteria like *Subdoligranulum* may help restrain HBV replication through immune activity, in contrast to *Faecalibacterium*, which supports immune tolerance. This reinforces the gut–liver axis as a key area of future therapeutic research [3,6].

4.3 Practical Tools for Maternal HBV Management

The data from Vietnam show the feasibility of qHBsAg as a reliable proxy for viral load—especially useful where DNA testing is limited. Early identification and TDF treatment in eligible pregnant women remain effective strategies for preventing vertical transmission [4,7].

5. Conclusion

By weaving together serological insights, microbiome findings, and maternal health data, our work highlights a multi-layered HBV problem—and a multi-pronged approach needed to tackle it. Enhanced vaccination, microbiome research, and improved access to antiviral therapy form the pillars of effective HBV control in high-burden settings.

6. Declaration of Competing Interest

The authors declare that they have no competing interests.

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