



letter to the Editor

An In-Depth Analysis of Determinants Influencing the Efficacy of Hepatitis B Vaccination in Pediatric and Adolescent Populations

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Dear Editor,

Hepatitis B virus (HBV) infection continues to pose a significant public health challenge globally, contributing to a considerable disease burden (1). The World Health Organization (WHO) reports that over 2 billion individuals worldwide have been infected with HBV, with approximately 350 million suffering from chronic infection (2). Chronic HBV infection can result in severe liver complications, including hepatitis, fibrosis, cirrhosis, and hepatocellular carcinoma (HCC). Notably, 15–25% of individuals with chronic infection ultimately succumb to cirrhosis or liver cancer (2).

The Importance of Vaccination and its Determinants

Despite the implementation of various preventive measures, such as blood donor screening and the production of hepatitis B immunoglobulin, active vaccination is recognized as the most effective strategy for preventing HBV transmission (3). Since its introduction in 1982, the hepatitis B vaccine has been widely administered and has demonstrated an efficacy rate exceeding 90% (4).

Individual and Genetic Factors

Age is a critical determinant of vaccine response. Infants should be vaccinated as early as possible to minimize the risk of HBV exposure; however, they often produce lower antibody levels, and maternally derived antibodies may interfere with vaccine-induced immune responses (5). Research indicates that only 40% of adolescents who were vaccinated at birth maintain antibody levels above 10 mIU/ml by age 15, and following a booster dose, only about half achieve protective levels (6). Nevertheless, long-term immunological memory persists even as antibody titers decline (7). Additionally,

gender influences antibody levels, with females generally exhibiting higher antibody responses than males (8). Furthermore, genetic and ethnic differences significantly impact vaccine response (9).

Underlying Diseases and Medical Conditions

Comorbidities such as celiac disease (CD) and diabetes can adversely affect immune responses to the vaccine (10). Additionally, children with chronic liver disease and thalassemia exhibit reduced responses to hepatitis B vaccination (11).

Perinatal and Nutritional Factors

Preterm infants and those with low birth weight (LBW) demonstrate less effective responses to vaccination, likely due to differences in their immune systems, and they exhibit lower antibody levels even after booster doses (12). Additionally, obesity and increased body mass index (BMI) are associated with reduced vaccine responsiveness (13). Geographical location and socioeconomic status further influence immune responses, with adults in developing countries exhibiting lower antibody responses to the hepatitis B vaccine (14). Furthermore, behavioral factors such as smoking significantly diminish antibody responses to the vaccine (15). The type and quantity of adjuvant included in the vaccine, the number and site of injections, storage conditions, and vaccine dosage all significantly impact vaccine effectiveness (16).

Conclusion

In summary, multiple factors—including age, gender, genetics, comorbidities, nutritional status, behavioral habits, and vaccine characteristics—significantly influence the efficacy of hepatitis B vaccination.

Recognizing and addressing these determinants is crucial for optimizing immunization policies and monitoring vaccine effectiveness. By doing so, we can enhance efforts to control and prevent hepatitis B infection.

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Authors' Contribution

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Competing Interests

The authors declare that there are no conflicts of interest to disclose.

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