

Original article

Evaluation of HBV Antibody Levels among Students at the Libyan International University: A Cross-Sectional Study

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Abstract

Hepatitis B virus (HBV) remains a global public health concern, particularly among healthcare professionals and medical students who face increased risk of occupational exposure. Although vaccination provides initial protection, anti-HBs antibody levels may decline over time, potentially compromising immunity. This study aimed to evaluate the levels of hepatitis B surface antibodies (anti-HBs) among medical students at the Libyan International University (LIU). A cross-sectional study was conducted from January to April 2025 involving 72 medical students who had completed the full HBV vaccination series. Venous blood samples were analyzed to measure anti-HBs titers. Protective immunity was defined as anti-HBs levels ≥ 10 IU/mL. A total of 72 students, of whom 55 (76.4%) were females and 17 (23.6%) males. The mean ages were 20.8 ± 1.4 , median 21 years. The majority, 56 (77.8%) of students are in Applied Medical Science. The study reported that anti-HBs antibody titers were a wide range from 0.2 to 52 mIU/mL with a mean of 9.7 ± 13.1 , median = 2.77. About 50 (69.4%) were less than 10 IU/mL, which means they had no immunity, while 22 (30.6%) had equal to or more than 10 IU/mL, considered as immune. The findings reported that there were no statistical differences between the students according to age, gender, or academic year. The findings indicate that despite full vaccination, a significant number of medical students do not retain protective antibody levels. This highlights the need for post-vaccination monitoring and consideration of booster doses, particularly among high-risk groups such as medical trainees.

Keywords. HBV Antibody, Vaccine, Medical Student, Libyan International University.

Introduction

Viral hepatitis is recognized as a significant global public health challenge, affecting hundreds of millions of individuals worldwide. It contributes substantially to morbidity and mortality, both through acute infection and chronic complications such as chronic active hepatitis, cirrhosis, and hepatocellular carcinoma (HCC). Among hepatitis viruses, HBV, hepatitis C (HCV), and hepatitis D (HDV) are most associated with long-term liver disease, with HBV being a leading cause of HCC, one of the ten most prevalent cancers globally [1]. HBV remains a major health concern, with an estimated 296 million people living with chronic HBV infection as of 2019. The virus contributes significantly to liver-related morbidity and mortality, including progression to cirrhosis and hepatocellular carcinoma [2]. The World Health Organization (WHO) recommends universal HBV vaccination as the most effective strategy to prevent infection and reduce disease burden. The standard vaccination regimen consists of three doses, and protective immunity is typically defined as an anti-HBs antibody level of ≥ 10 IU/mL. However, several studies have indicated that anti-HBs levels may decline over time, especially among high-risk populations such as healthcare workers and medical students, who are frequently exposed to potentially infectious materials [3].

In Libya, the HBV vaccine was introduced into infant immunization schedules by the Ministry of Health in 1993. Subsequently, children born in 1991-92 and 1989-90 were vaccinated during the 2005 and 2006 vaccination campaigns, respectively. Vaccination schedules in Libya follow the recommendations of the WHO and the Advisory Committee on Immunization Practices (ACIPI 2005): the zero dose at birth (monovalent) containing only HBsAg, the first dose at 2 months, the second dose at 4 months, and the last dose at 6 months of age (hexavalent). The Hexavalent vaccine (6 in 1) protects against six main Pathogens, which are Diphtheria, Pertussis, Tetanus, Haemophilus Influenzae type B, Hepatitis B, and Polio, in a single injection. The duration of protection provided by the vaccine is unknown. Additional screening programs are in place for pre-marital testing and employment, indicating a broader national commitment to controlling HBV transmission [4-6].

Medical students are particularly vulnerable to HBV exposure due to their contact with blood and bodily fluids during clinical training. Although primary vaccination induces high seroconversion rates, long-term immunity is not guaranteed. Several studies have reported declining antibody levels over time, raising concerns about waning protection in this high-risk group [7]. A study at Shiraz University of Medical Sciences revealed that many vaccinated freshmen had anti-HBs levels below the protective threshold [8]. Similarly, research in Serbia showed that although most participants retained seroprotection, a substantial portion had inadequate antibody titers [9].

Despite this, there is currently no national policy mandating HBV vaccination specifically for medical students. A study conducted in Benghazi reported that only 52.5% of medical staff and students had received the full three-dose series, while 47.5% were either incompletely vaccinated or entirely unvaccinated [10].

This highlights a significant protection gap in a population that is highly susceptible to occupational exposure. Given the occupational risks faced by medical students, assessing their seroprotection status is essential to ensure adequate immunity and prevent HBV transmission. This study aims to evaluate the levels of anti-HBs antibodies among students from different faculties at the Libyan International University (LIU). The findings will provide insight into the effectiveness of existing vaccination practices and identify students with insufficient protection, guiding the need for booster doses.

Methodology

Study Design

A Cross-Sectional study conducted from 1st January to 30th April 2025.

Students and Sample

Undergraduate students from health-related faculties at Libyan International University (LIU), both sexes, who had completed the full HBV vaccination series. Students from non-medical colleges and with a known history of HBV infection, or those who have not received the complete vaccination series, were excluded.

Sample size determined based on the students' responses; 72 participants were collected. A structured questionnaire was used to collect primary demographic data, including age, gender, and faculty.

Blood Samples Analysis

Venous blood samples were collected from participants to assess anti-HBs antibodies titers. The measurement was conducted using HBsAb COBAS (compact Biochemical Analyzer system) at Al-Saleem Medical Laboratory in Benghazi. Serological testing was conducted to quantify the levels of anti-HBs in serum samples. Results were categorized based on established thresholds: adequate immunity (>10 IU/mL) and inadequate immunity (<10 IU/mL) [7].

Statistical Analysis

Data obtained from the structured self-administered questionnaires and laboratory results were analyzed using SPSS (Statistical Package for the Social Sciences) software version 25. Descriptive and inferential statistics were used to analyze the data and the anti-HBs antibody level. The quantitative variable, age, was expressed as the mean, median, and standard deviation. Categorical variables, gender and occupation, were expressed as percentages. Statistical tests such as the chi-square test were employed to analyze associations between demographic variables and antibody titers. A chi-square test was conducted for antibody titers among different age groups, gender, and faculty, and a P value of < 0.05 was considered statistically significant.

Ethical Considerations

Informed consent was obtained from all participants, ensuring they understood the purpose of the study and their right to withdraw at any time. Secure approval from the university's ethics review board before commencing the study. Ensure that all data collected is kept confidential and stored securely, with access limited to the research team.

Result

There were 72 subjects, of whom 55 (76.4%) were females and 17 (23.6%) males. The mean ages were 20.8 ± 1.4, median 21 years, and ranged from 18 to 27 years; most were 51 (70.8%) at age 21. The majority, 56 (77.8%) of students in Applied Medical Science (Table 1).

Table 1: Distribution of students according to age/years, gender, and faculty.

Variable	Frequency (n)	Percentage (%)
Age /Years		
18	1	1.4
19	12	16.7
20	2	2.8
21	51	70.8
22	3	4.2
23	1	1.3
27	2	2.8

Gender		
Female	55	76.4
Male	17	23.6
Faculty		
Applied Medical Science	56	77.8
Clinical Laboratory Science	1	1.4
Dentistry	5	6.9
Medicine	8	11.1
Nursing	1	1.4
Pharmacy	1	1.4

The study reported that anti-HBs antibody titers were a wide range from 0.2 to 52 IU/mL with a mean of 9.7 ± 13.1 , median = 2.77. About 50 (69.4%) were less than 10 IU/mL, which means they had no immunity, while 22(30.6%) had equal to or more than 10 IU/mL, considered as immune. (Figure 1, 2)

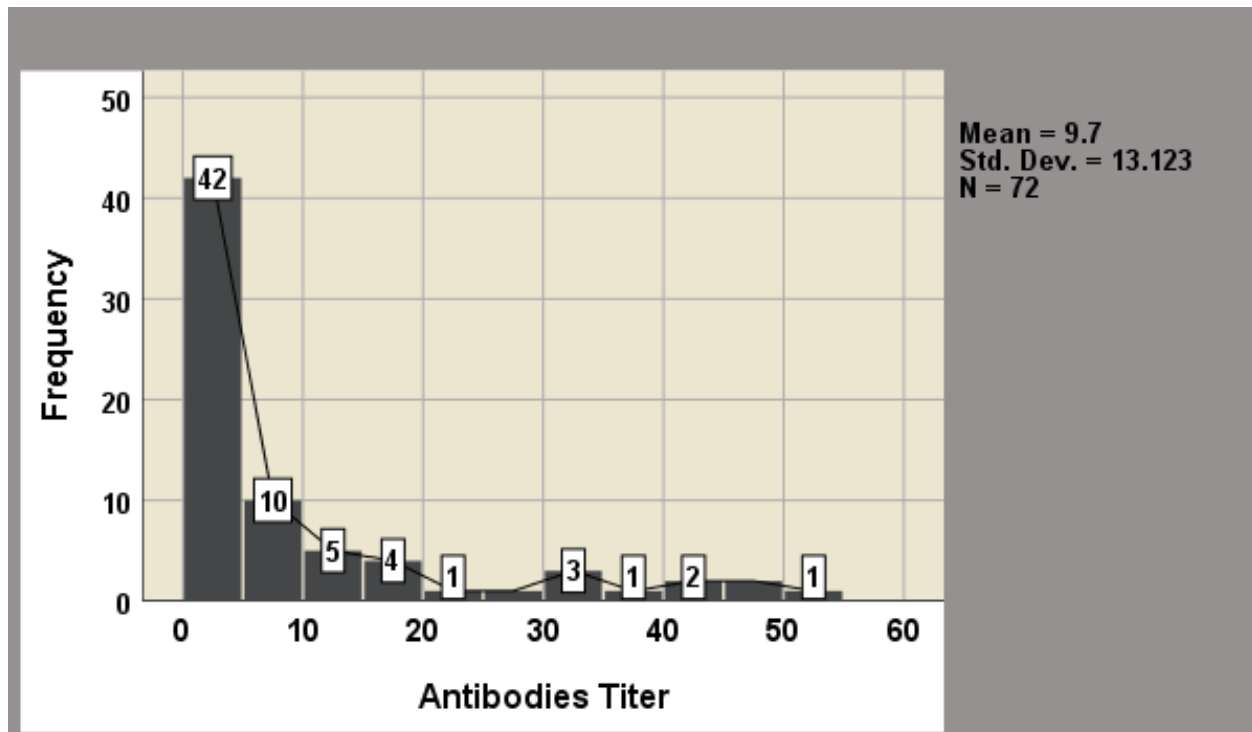


Figure 1. Distribution of students according to antibody Titer.

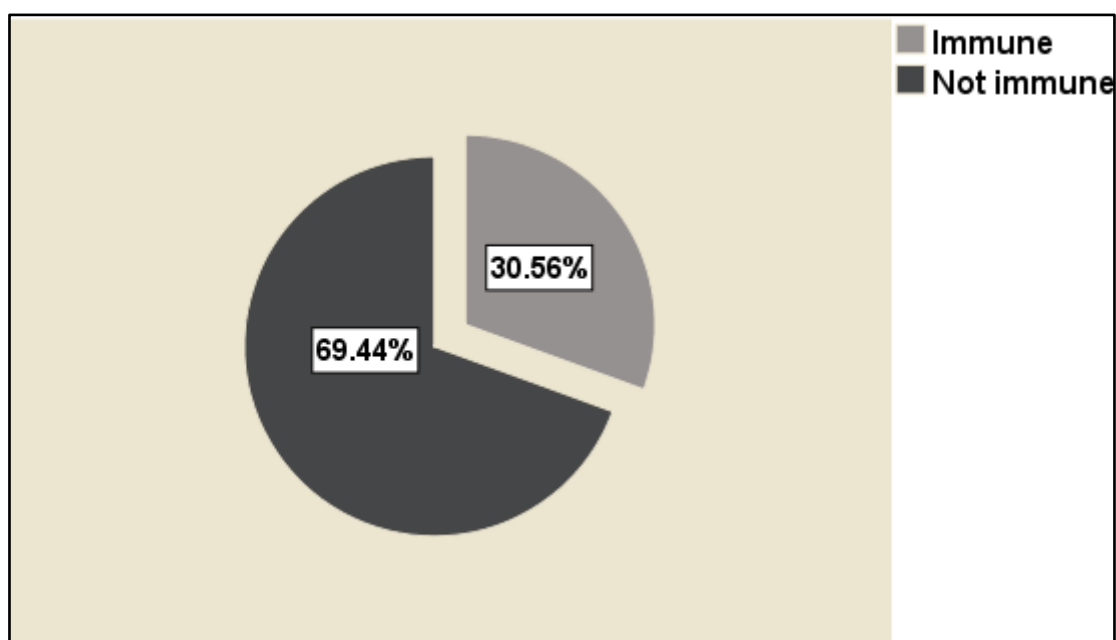


Figure 2. Distribution of students according to immunity status.

The findings reported that there were no statistical differences between the students according to age, gender, or academic year (Table 2).

	Immune	Not immune	Total	P value
Age/Years				
18	1	0	1	0.604
19	2	10	12	
20	1	1	2	
21	16	35	51	
22	1	2	3	
23	0	1	1	
27	1	1	2	
Gender				
Female	18	37	55	0.559
Male	4	13	17	
Faculty				
Applied Medical Science	14	42	56	0.186
Clinical lab. Sciences	0	1	1	
Dentistry	3	2	5	
Medicine	4	4	8	
Nursing	1	0	1	
Pharmacy	0	1	1	

Discussion

The present study evaluated the levels of anti-HBs antibodies among students at LIMU to assess the persistence of immunity following completion of the standard three-dose hepatitis B vaccination series. A substantial deficit in serological protection against Hepatitis B, with 69.4% of participants exhibiting anti-HBs titers below the protective threshold (<10 IU/mL). This finding is striking given that the study population consists of healthcare-oriented students, a group for whom adequate immunity is not only recommended but essential. The results challenge the assumption that prior childhood vaccination alone is sufficient to sustain protection into early adulthood, particularly in high-risk occupational settings.

The lack of statistically significant associations between immunity status and age, gender, or faculty suggests that waning immunity is pervasive and non-discriminatory across subgroups. This reinforces the notion that the observed immunity gap is not behaviorally or demographically driven, but rather reflects systemic shortcomings in long-term immunization monitoring. The narrow age distribution (predominantly 21 years) further supports the likelihood that declining antibody levels are temporally linked to the interval since primary vaccination during infancy.

Compared to existing Libyan literature, the current findings indicate a comparatively lower level of seroprotection. Previous studies conducted among healthcare workers and students in Libya have

reported moderate immunity levels ranging between 40% and 60% (Abdulwahab et al., 2019; El-Gadi et al., 2021) [11,12]. The higher proportion of non-immune individuals in this study may reflect inadequate documentation of vaccination history, absence of booster dose policies, or inconsistent post-vaccination serological testing. It may also point to gaps in institutional health policies that fail to prioritize preventive screening before clinical exposure.

Regionally, studies from North Africa and the Middle East report higher retained immunity levels, generally between 40% and 60% among similar cohorts (Alqahtani et al., 2018; Yousif et al., 2020) [13,14].

While these studies also acknowledge waning antibody titers over time, the magnitude observed in the present study appears more pronounced. This discrepancy may suggest variations in vaccine program implementation, cold chain maintenance, or adherence to booster recommendations, highlighting potential contextual challenges within the Libyan healthcare education system. At the global level, the findings are consistent with well-documented evidence that anti-HBs levels decline significantly 10–20 years after primary vaccination, often falling below protective thresholds despite the persistence of immune memory (Poorolajal et al., 2019) [15]. However, reliance on immunological memory alone remains controversial. While it may reduce the risk of severe disease, it does not guarantee sterilizing immunity or prevent transmission. In high-risk populations such as healthcare students, serological protection rather than theoretical immunity should be the standard benchmark, particularly in environments with potential exposure to blood and body fluids.

The wide dispersion of antibody titers (0.2–52 IU/mL) and the low median value (2.77 IU/mL) further underscore the heterogeneity and overall immune insufficiency within the cohort. This pattern suggests that a substantial proportion of students may have either experienced primary vaccine non-response or complete antibody waning, both of which necessitate targeted intervention. The absence of individuals with consistently high titers also raises questions about long-term vaccine-induced immunity durability in this population.

From a critical public health perspective, these findings expose a structural vulnerability in infection control preparedness among future healthcare professionals. The lack of routine screening for anti-HBs levels before clinical exposure represents a missed opportunity for early intervention. In contrast, international guidelines strongly recommend pre-exposure screening and booster vaccination for healthcare workers with anti-HBs levels below 10 IU/mL (Trevisan et al., 2019) [16]. The failure to implement such measures may increase the risk of occupational transmission of Hepatitis B within healthcare settings. In conclusion, this study highlights a substantial and potentially overlooked immunity gap among healthcare students. The findings call for an urgent shift from passive reliance on childhood vaccination history to active serological surveillance and booster dose implementation, particularly in high-risk populations. Without such measures, the current trajectory may compromise both individual protection and broader infection control efforts.

Strengths and Limitations

This study provides valuable baseline data on immunity status among healthcare students in Libya, addressing a relatively underexplored area in the local context. The use of quantitative antibody measurements enhances the reliability of the findings.

However, several limitations must be acknowledged. First, the relatively small sample size (n=72) and single-institution design limit the generalizability of the results. Second, the lack of detailed vaccination history (e.g., number of doses, timing, booster status) restricts the ability to distinguish between primary vaccine failure and waning immunity. Third, potential confounders such as underlying immunological conditions were not assessed. Finally, the cross-sectional design precludes causal inferences.

Conclusion

This study demonstrated that a significant proportion of medical students at the Libyan International University do not retain protective levels of anti-HBs antibodies despite completing the full HBV vaccination series during childhood. The findings highlight potential gaps in long-term immunity among future healthcare workers and support the need for routine monitoring of antibody levels. Strengthening vaccination follow-up and providing booster doses when needed can help ensure adequate protection and reduce occupational risks related to HBV transmission in clinical training settings.

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Conflicts of Interest

The authors declare no conflicts of interest

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