

## Measurement of Immune response to rDNA hepatitis B vaccine in medical laboratory students, Wad Medani, Sudan

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### Abstract

**Introduction:** The level of immune response to hepatitis B virus vaccine is an indicator of whether the expected protection has been achieved in the target population.

**Objective:** the study aimed to determine the immune response to recombinant hepatitis B virus rDNA among students in two medical laboratory colleges in Wad Madani city in Sudan.

**Methods:** A cross-sectional laboratory based study conducted during 2019. The assigned subject was 72 medical laboratory students who completed all three doses of HBV rDNA vaccine. Immune response indicated by quantitatively measuring of HbsAbs (anti-HBs) using a sandwich ELISA approach. Data was collected after verbal meeting with each participants, and descriptively analyzed accomplished by SPSS computer program.

**Results:** Enrolled participants were 50 % (36 /72) from Gezira University while the other 50 % were from Wad Medani College for Medical Science and Technology. Males represented 22% (16/72) while 78% (56/72) were females. Titers of anti-HBs ranged from 0.000 to 9478 mIU/ml, only 6 students (three males and three females) were non-responders. The overall index of significant titer detected in 78% (56/72) of participant whereas 22% (16/72) showed insignificant titer. Strong immune response with titer above 100 mIU/ml recorded in 46% (33/72).

**Conclusion:** The level of immune response to the HBV rDNA vaccine among studied students was below the internationally recognized index.

**Keywords:** Hepatitis B virus; rDNA vaccine; Immune response; Sudan

### 1. Introduction

Hepatitis B virus (HBV) is one of the most important blood-borne pathogens responsible for acute and chronic hepatitis B infections [1]. Infection with the virus is widespread throughout the world, and cases of infection are increasing in African countries [2]. Hepatitis B virus is mainly transmitted through transfusion of blood and blood products, sex and contaminated surgical instruments, so it is easily transmitted to medical personnel during work exposure [3]. Methods of controlling the transmission of HBV include immunizing individuals, blocking

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transmission routes and clinical treatment [4]. Proper immunization using hepatitis b vaccine (HebB) is an easy and effective way to reduce potential hepatitis B virus infections and thus limit its spread in communities, however, immunization failure is related to variables and risk factors such as age, gender, weight, smoking and medication with immunosuppressant's [5]. Some types of hepatitis B vaccine may be approved as a standard routine for infants while others may be used only for adults. The number of doses and scheduling of administration are essential for effective immune responses [6, 7]. Recombinant hepatitis B vaccine includes non-infectious hepatitis B virus antigens such as HbsAg. Immune responses against HbsAg can be verified by detection of corresponding HbsAbs [8], and additional quantification of HbsAbs (anti-HBs) reflects the level of immune status against HBV. For all of the above, it is important to detect the level of antibodies resulting from the immunization process in order to know the effectiveness of the used vaccine and monitor the lifespan of protection. Studies revealed that insufficient doses led to low levels of protective antibodies produced [9]. Challenges such as weak funding and inadequate logistics services contribute to limited control of HBV, especially in poor countries [10]. In Sudan, according to Mudawi and his group, immunization against hepatitis b virus began in 2005 [11]. The current study aimed to determine the immune response resulting from vaccination with recombinant hepatitis B virus rDNA among students in two medical laboratory colleges in Wad Madani city in Sudan.

## 2. Methods

### 2.1. Design and settings

A cross-sectional laboratory-based study was followed during 2019 and approved by the Faculty of Medical laboratory Sciences, University of Gezira. Sudanese medical laboratories students vaccinated against hepatitis B virus from Gezira University and Wad Medani Collage of Medical Sciences and Technology. Participants received three doses of recombinant rDNA HBV vaccine and take six months after the third dose were included. Individuals under immunosuppressive drugs or infected with HIV were excluded. Data of study was collected after verbal meeting with each participants, and descriptively analyzed done by SPSS computer program (version 20).

### 2.2. Sampling and HbsAbs measurement

After alcoholic disinfection, 5ml of venous blood was obtained from each participated student and left for complete clotting at 37 °C for 45 minutes. Then serum was separated by centrifugation and stored at -20 °C until used. HbsAbs were quantitatively detected using sandwich enzymatic ELISA technique according to the manufacture constrictions (Fortress Diagnostics Limited, United Kingdom). The absorbance of the test was read using an ELISA microplate reader (Awareness Technology, Model: 303 PLUS, USA). HbsAbs titer of  $\geq 10$  mIU/ml considered significant for immune response.

## 3. Results

In this study a total of 72 student participants were enrolled, 50 % (36 /72) of students were from Gezira University while the other 50 % were from Wad Medani College for Medical Science and Technology. All participants were completed three doses of rDNA vaccine. Titers of measured HbsAbs ranged between 0.000 to 9478 mIU/ml, 6 students (three males and three females) showed zero titer. The overall index of significant titer detected with 78% (56/72) of participant whereas 22% (16/72) showed insignificant titer. Strong immune response with titer above 100 mIU/ml recorded in 46% (33/72) (Table 1). The ages of participants ranged between 18 to 25 years with the mean age of 21.5 years. Males represented 22% (16/72) while 78% (56/72) were females (Table 2). Most studied students appeared in vaccination duration periode of less than one year (Table 3).

**Table 1** Frequency of significant and insignificant immune response of HBV rDNA vaccine among participated student

Antibody titer mIU/ml	Significant/ Insignificant	Frequency	Percentage %
0-9	Insignificant	16	22
10-99	Significant	23	32
Above 100	Significant	33	46
Total	Significant/Insignificant	72	100

**Table 2** Frequency of significant and insignificant immune response of HBV rDNA vaccine in gender.

Antibody titer mIU/ml	Significant/ Insignificant	Frequency	Gender		Percentage %
			Male	Female	
0-9	Insignificant	16	4	12	22
10-99	Significant	23	3	20	32
Above 100	Significant	33	9	24	46
Total	Significant/Insignificant	72	16	56	100

**Table 3** Frequency of significant and insignificant immune response of HBV rDNA vaccine according to vaccination duration

Last vaccine dose	Frequency	Anti-HBs Ab titer mIU/ml			Percentage
		0 -9	10 – 100	Above 100	
Less than Year	39	8	14	17	54
1 – 2 Years	28	7	9	12	39
More than 2Years	5	1	1	3	7
Total	72	16	24	32	100

#### 4. Discussion

Immunization is considered the best way to limit the transmission of hepatitis B virus [12], however, cases of poor immune response to the (recombinant) rDND HBV vaccine type have been reported in a proportion of the elderly, smokers, and immunocompromised individuals, moreover, several studies have confirmed decreased levels of immune response resulting from the use of recombinant hepatitis C vaccine over time [13]. Generally, the international immune response rate to hepatitis B virus vaccines is about 90%, with varying international studies [14]. Effective rDNA immunization against hepatitis B is determined by an immune response with an antibody level of  $\geq 10$  mIU/mL [15,13].

The current study reported an immune response rate to the HBV rDNA vaccine of 78% among studied medical laboratory students, this result is lower than the global average recorded or required, and therefore a significant percentage of the students included in the study did not have adequate protection against the virus. Such participants prefer to undergo a booster dose to increase the level of protection in their bodies [16, 17]. This also necessitates conducting a comprehensive national study to find out the existent protection rate against the HBV. Similar finding was documented in Africa in Nigeria in 2018 among medical students, with immune response rate of 79.1% [18], however, in other Arabian country; Egypt a research found all subject medical students as protective with anti-HBs levels of more than 100 IU/L [19]. It

was noted from the results of the study that, antibody levels decrease over time, also this indicates the importance of monitoring the level of protection in people, especially those most at risk of infection, such as surgeons and blood bank workers [20] as well as patients with chronic kidney diseases (CKDs) [21].

This study showed a slight difference in the level of immune response among the study population compared to a similar study conducted in Khartoum in health workers in which a rate 90% was observed [22], our study also found a zero immune response rate in six students, and this was not recorded in the above mention study. These individuals may be subjected to genetic or immunological studies to determine the causes for the lack of response. The reasons for the absence of an immune response are multiple; include, firstly, the inability of the immune system to recognize antigens or produce antibodies. Secondly, technical errors such as poor preservation of vaccine before administration and the sensitivity of the laboratory method used for antibodies detection.

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## 5. Conclusion

The level of immune response to the HBV rDNA vaccine among the students included in the study was below the internationally recognized index.

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## Compliance with ethical standards

### *Acknowledgement*

The authors extend their thanks to the students and staff of the Faculty of Laboratory Medical Sciences at the University of Gezira and the Wad Madani Medical College of Science and Technology.

### *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.

### *Study limitation*

This study was limited by sample size, the number of males and females was small and close together, and thus no association could be observed.

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