

⇒ Research Article



Hepatitis B Vaccination Coverage, HBS-Ab Level and its Related Factors among Dentistry and Medical Students

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Background: In Iran, hepatitis B vaccination has been routinely performed for infants since 1993. This vaccination has also been suggested for individuals at risk. Recently, with the birth of children in 1993 and later to the age of entry to the university, assuming they were vaccinated against hepatitis B at birth, the issue of tracking the immunity of these students has been obscured or neglected. Moreover, the entry of some individuals born before 1993 to the university who have not been immunized against this disease in childhood, has made this issue more complicated.

Objectives: The aim of this study was to investigate Hepatitis B Vaccination Coverage, HBS-Ab level and its related factors among dentistry and medical students.

Methods: This study was a cross-sectional study performed through providing a checklist and serological tests. After obtaining written consent from the students, the information of 300 students were entered into SPSS software, version 16.0, and analyzed using descriptive statistics. Kruskal-Wallis and Mann-Whitney U tests were used and $P < 0.05$ was considered as statistically significant.

Results: Of the 300 students, 55%, 28.7%, and 16.3% had weak, medium, and good HBS-Ab titer with rates of less than 10, 10 to 100, and more than 100, respectively, moreover, the mean HBS-Ab titer was significantly different between different immune groups (Weak, Medium, and Good) ($P = 0.000$) (Write $P < 0.001$ instead of $P = 0.000$). Vaccination coverage was at a very low level so that only 6.3% of the subjects completed the hepatitis B vaccination in the past 1 to 5 years (when entering university). the mean HBS-Ab titer was significantly correlated with the time elapsed since the last vaccination ($P < 0.05$) (It was better to write the exact P values). The immunity level among the married individuals and clinical students was significantly higher compared to the single individuals and preclinical students, respectively ($P < 0.05$).

Conclusions: Considering the low level of vaccination coverage among the students of Hormozgan University of Medical Sciences (6.3%) compared with other universities, it is better to design a program that will allow all students enrolled in such fields to receive hepatitis B vaccination when entering the university.

Keywords: HBS-Ab titer, Vaccination coverage, Hepatitis B

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Background

Hepatitis B virus (HBV) infection is the most prevalent chronic viral infection and about two billion people have been infected with this virus worldwide (1). According to the World Health Organization (WHO) estimates, 257 million individuals (3.5%) of the world's population lived with chronic HBV infection worldwide in 2015. Moreover, 887 thousand deaths occur annually because of HBV, often because of its long-term complications, including cirrhosis and hepatocellular carcinoma. Furthermore, about half of deaths from liver cancer has been associated with HBV infection (2). The widespread use of hepatitis B vaccine has significantly reduced the incidence rate of new chronic HBV infection among infants, so that since the start of the global vaccination program (which varies

from 1980s to the early 2000s) until 2015, the ratio of children under the age of 5 who were chronically affected by this virus has fallen from 4.7% to 1.3%, and most of individuals currently living with HBV infection are those who have been born prior to the start of the national vaccination program (2). By the end of 2011, vaccination against HBV infection in children's routine vaccination programs has been implemented in 180 countries (3). In various studies, the effective response to the vaccine (based of the definition, individuals with HBS-Ab of more than 10 miu/ml) has been achieved among almost 95% of healthy individuals, with a preservation and durability of more than 15 years (4-6). In Iran, hepatitis B vaccination program has been routinely executed among infants since 1993 (7). Moreover, this vaccine is

recommended for individuals at risk such as dental and medical students. However, the vaccination of students has not been followed up seriously and is not mandatory for them. In the past, students born before 1993 (as the high-risk group), were routinely introduced to health centers to receive a hepatitis vaccine and were vaccinated when entering the university. In recent years, with the birth of individuals in 1993 and later to the age of entry to the university, assuming they were vaccinated against hepatitis B at birth, the issue of tracking the immunity of these student groups has been obscured or neglected. Given the current situation, the entry of some individuals born before 1993 to the university who have not been immunized against this disease in childhood, has made this issue more complex. Therefore, we decided to examine hepatitis B vaccination coverage, HBS-Ab level and its related factors among dentistry and medical students.

Methods

Study design and setting

This study was an observational cross-sectional and descriptive-analytic study conducted by providing a checklist and serological tests. This study was done on the students of dental and medical schools of Hormozgan University of Medical Sciences during the fall and winter seasons of 2017.

Study participants and sampling

Based on the information obtained from the Deputy Education of Hormozgan University of Medical Sciences, the total number of dental and medical students of this university was 1200. Using the Cochran formula with 95% confidence level and 5% error rate, as well as considering the incidence rate of the disease in previous studies (50%) (8), the required sample size was calculated to be 291 individuals, and by considering the possible drop-out rate, 320 individuals were considered for the study. The sampling was performed using multi-stage cluster method. All dental and medical students who were completely willing to participate were enrolled regardless of their history of vaccination.

Data collection, variables, and measurements

After obtaining written consent from the students, 5cc blood sample was taken from them. To determine the antibody level against HBV, all the samples were evaluated for HBS-Ab level by enzyme-linked immunosorbent assay (ELISA) and using anti-HBs Pishtazteb kit in the laboratory of Shahid Mohammadi Hospital affiliated to Hormozgan University of Medical Sciences. HBS-Ab levels below 10 mIU/mL were considered as weak, and HBS-Ab levels of 10-100 and more than 100 mIU/mL indicated medium and good immunity levels, respectively. After collecting checklists, some of them were excluded from the study because of numerous drawbacks. Ultimately,

the information of 300 individuals were entered into the SPSS software (version 16.0, SPSS Inc., Chicago, IL, USA). The checklist for each individual included demographic information and questions about the variables. In all stages of the research, their information was considered and remained confidential.

Data analysis

Data were analyzed by SPSS software, version 16. Initially, Kolmogorov-Simonov test was used to examine the normal distribution of HBS-Ab titer variable, and it was found that the data had an abnormal distribution, then they were evaluated using descriptive statistics such as mean and standard deviation (SD) of quantitative variables and percentage rate of qualitative variables, and Kruskal-Wallis H and Mann-Whitney U tests. Moreover, $P < 0.05$ was considered as statistically significant.

Results

This study was performed on 300 students of dental and medical students of Hormozgan University of Medical Sciences during the fall and winter seasons of 2017. The study population consisted of people born during 1980-1999. 44 of them were born before 1993 and 256 were born after 1993. This is important for us because people born after 1993 have participated in the national neonatal vaccination plan. 173 (57.7%) and 127 (42.3%) of the participants were men and women, respectively. 165 (55%), 86 (28.7%), and 49 (16.3%) of the subjects had weak, medium, and good level of HBS-Ab titer with rates of less than 10, 10, to 100 mIU/mL, and more than 100 mIU/mL, respectively (Figure 1). The mean HBS-Ab titers were significantly different in different immune groups (weak, medium, and good) ($P = 0.000$).

Vaccination coverage was at a very low level so that only 6.3% of the participants completed the hepatitis B vaccination in the past 1 to 5 years (when entering university, Table 1). The mean HBS-Ab titer had a significant relationship with the time elapsed since the last vaccination, so that the mean HBS-Ab titer among individuals with the last vaccination in the past 1 to 5 years was significantly higher compared with individuals

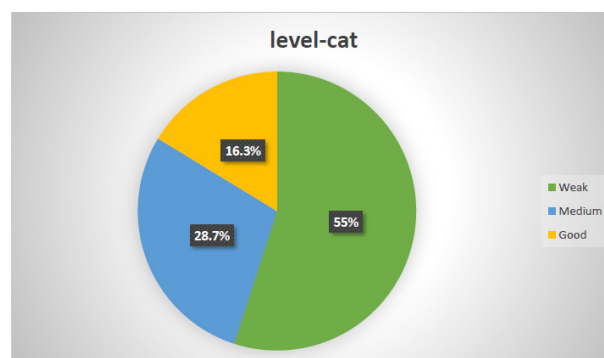


Figure 1. Immunity level of students in percent

Table 1. Characteristics of 300 dental and medical students based on the time of the last vaccination

Characteristics	Vaccinated in 20-25 years ago	Vaccinated in 5-15 years ago	Vaccinated in 1-5 year ago	Without vaccination	P value
Number of student (%)	242(80.66%)	14(4.66%)	19(6.3%)	25(8.33%)	-
Age	20.93±1.48	27.71±2.81	23.57±3.11	27.52±3.29	0.000
Sex(male/female)	140/102	5/9	10/9	18/7	0.127
Field(dentistry/medical)	119/123	13/1	17/2	19/6	0.000
Section(preclinical/clinical)	148/94	2/12	4/15	7/18	0.000
Students with HBS-Ab<10	150	0	0	15	
Students with 10≤HBS-Ab<100	78	2	1	5	0.000 ¹
Students with HBS-Ab≥100	14	12	18	5	

Relationship between different immunity levels and the time of the last vaccination (Kruskal-Wallis H test)

who had their last vaccination in the past 5 to 25 years (Figure 2). The mean value of HBS-Ab titers among the individuals born before the launch of the vaccination program was significantly higher among those born after the start of this program ($P < 0.05$). In other words, the mean of HBS-Ab titers was higher among older people.

The immunity level of the married individuals was significantly higher compared with the single ones (effect size [ES] = -0.405, $P = 0.046$). Moreover, the immunity level in women was higher than that of men (ES = 0.137, $P = 0.347$), of course this relationship was not significant.

The immunity level of individuals studying in clinics was significantly higher than the ones studying in preclinical stage ($P = 0.049$, ES = 0.231). Furthermore, the immunity level among the dentistry students was significantly higher than the mean titer in medical students ($P = 0.003$, ES = 0.239, Table 2).

The level of immunity did not show a significant relationship with the variables of body mass index (BMI), family income, exercise, smoking, alcohol use, and type of blood group ($P > 0.05$).

Discussion

The results of this study revealed that more than half of the dental and medical students studied (55%) had

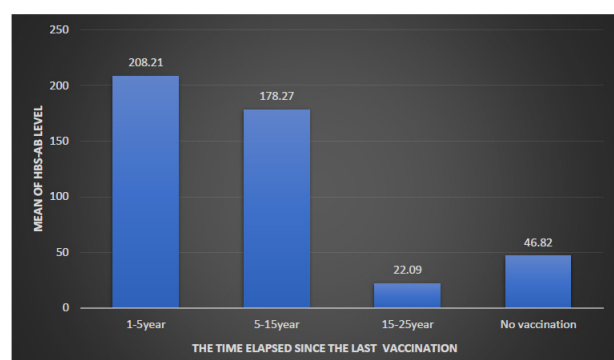


Figure 2. Relationship between the antibody titer and the time elapsed since the last vaccination

poor antibody titers (HBS-Ab<10), most of whom being those who had received the vaccine only at birth and the rest being individuals with no record of vaccinations at all. As mentioned, a portion of the study population was individuals who were not included in the national vaccination program. From this group, a number of individuals had received three doses of HBV (complete vaccination) spontaneously or by their university and the others had not received hepatitis B vaccine at all (without vaccination). The mean value of HBS-Ab titers among the individuals born before the launch of the vaccination program was significantly higher among those born after the start of this program. Since these individuals have not received the hepatitis B vaccine at birth, they may have received the vaccine for example in high school, during the military service, or during the previous university degrees spontaneously or from the relevant health centers. Vaccination is the main procedure of preventing HBV. However, issues such as the number of vaccines needed, the appropriate age for receiving these doses, the need or lack of need for booster doses, etc., have been the place of disagreement. Moreover, the effectiveness of the hepatitis B vaccine has varied in various studies taking into account the time elapsed since the last dose of vaccine, the age of receiving the vaccine, the population studied, the residence place, and the incidence rate of hepatitis B. Table 3 demonstrates the effectiveness of hepatitis B vaccination in various studies.

As shown, in all studies, the effectiveness of vaccination against HBV drops over time, and the high rate of vaccination effectiveness in some of the studies can be attributed to the circumstances of performing the study including the population studied, the incidence of HBV in the region, the lifestyle of individuals, the age of receiving vaccine doses, the number of doses of vaccination, the time past from the last dose of vaccination, and even the year of conducting the study. In the present study, the immunity level was significantly reduced over time. However, as seen in this figure, a relative increase can be

Table 2. Relationship between type of field and educational level with immunity level

Field				HBS-Ab groups			Total
				Weak	Medium	Good	
Dentistry	Section	Preclinic	Count	25	17	5	47
			% within section	53.2%	36.2%	10.6%	100.0%
			%within HBS-Ab groups	30.9%	37.0%	12.2%	28.0%
	Clinic	Count	56	29	36	121	
		% within section	46.3%	24.0%	29.8%	100.0%	
		%within HBS-Ab groups	69.1%	63.0%	87.8%	72.0%	
	Total	Count	81	46	41	168	
		% within section	48.2%	27.4%	24.4%	100.0%	
		%within HBS-Ab groups	100.0%	100.0%	100.0%	100.0%	
Medical	Section	Preclinic	Count	70	37	7	114
			% within section	61.4%	32.5%	6.1%	100.0%
			%within HBS-Ab groups	83.3%	92.5%	87.5%	86.4%
	Clinic	Count	14	3	1	18	
		% within section	77.8%	16.7%	5.6%	100.0%	
		%within HBS-Ab groups	16.7%	7.5%	12.5%	13.6%	
	Total	Count	84	40	8	132	
		% within section	63.6%	30.3%	6.1%	100.0%	
		%within HBS-Ab groups	100.0%	100.0%	100.0%	100.0%	

Table 3. Effectiveness of hepatitis B vaccination on rising the HBS-Ab titer in various studies

Efficacy of vaccination (HBS-Ab≥10)	Years past from vaccination	N of Vaccination doses	country	Number of participants	Vaccinated population	Year of publication	Reference
51.72%	10	3-4doses Starting at birth	UK	116	Infants of carrier mothers	2004	(9)
91.2%	11	3doses	Italy	228	Adolescents	2007	(10)
64% infants and 89%recruits	10	3doses	Italy	1212 infants and 446recruits	Infants and recruits	2005	(11)
37.8%	15-21	3doses Starting at birth	Taiwan	6156	Infants	2008	(12)
50%	20	3doses Starting at birth	Iran	441	Infants	2014	(8)
60%	22	3doses	Alaska native	493	Age>6month	2009	(5)
56%	22	3doses	Alaska native	71	Age=6month-4year	2009	(5)
81.1%-81.8%	15	2-3doses	Czech Republic and Belgium	162	Age= 12-15 years	2016	(13)
51.44%	30	3doses	Alaska native	243	Age>6month	2016	(14)
77%	21	3doses Starting at birth	Italy	588	Infants	2015	(15)
93.5%	14	3doses Starting at birth	Iran (Isfahan)	200	Infants	2012	(16)
71%	10-15	3doses Starting at birth	Iran (Semnan)	76	Infants	2014	(17)

observed in the mean HBS-Ab titer among individuals without a history of vaccination; this increase in the HBS-Ab titer can be attributed to a variety of reasons, such as the respondents' error regarding receiving or not receiving a vaccine or the remaining high rate of HBS-Ab

titer because of having a history of HBV infection.

Given the reduction of HBS-Ab protection titer over time, it has been suggested that individuals with risky occupations receive booster dose or doses to increase their immunity, and since dental and medical students

are directly at risk of transmitting infections to patients through different ways, it is suggested that the immunity of these individuals be specially considered (17-19). Table 4 illustrates the manner of vaccination of medical students in different European countries (20).

In this study, it was observed that Hormozgan Medical University lacked a suitable monitoring of hepatitis B vaccination and it was only offered to students just as a suggestion. Definitely, this is one of the most important reasons for the low vaccination coverage among the students (only 6.3%). However, this rate is much better in other studies. In Nigeria, Solofa and colleagues and Okeke and colleagues reported vaccination coverage of 47.7% and 37.9% for medical students and dental students, respectively. Similarly, Al-Dabbas reported a 76.8% coverage of vaccination for medical students (21, 22). Moreover, since the past several years, in universities such as the Frankfurt University of Medical Sciences, Germany, which has approximately 2,730 and 4,200 medical students and employees, respectively, there is a plan for the free vaccination for all health care workers and the first checkup of the medical students is done in the second year of study, before dealing with a patient (23).

In the present study, the immune system response to vaccination was better in women compared to men, however there was no significant relationship. This was consistent with the result of another study (24). However, in other studies (25, 26), immune responses to vaccination in women were significantly higher compared with men. The most important causes for the differences in studies include cases such as the age range of the subjects, the time of the first vaccination, the regional incidence of hepatitis, the sensitivity of the measuring kits, etc. In most studies, immune response was better in men than women, however the reason for this issue is still unclear.

In the current study, there was a significant relationship between the level of immunity against HBV (weak,

medium and good) and marital status, but in most other studies (27, 28), there was no specific relationship between these two variables, and the reason for the significant relationship in this study may be attributed to the low number of married individuals.

In this study, vaccination and hence, the mean HBS-Ab titer among clinical students was higher than that of pre-clinical students; this finding was similar to those reported in the studies by Sabine Wicker, Kesieme, Okeke and their colleagues (22, 23, 29). Of course, as shown in table 3, this higher HBS-Ab titer was true in dental individuals of clinical students, and this is somehow inverse in medicine, which may be related to the fact that the number of individuals selected from medical clinics is much lower than the medical preclinical students. This lower number of selected clinical medical students has caused the mean HBS-Ab titers among dentistry students to be significantly higher than medical students ($P=0.003$, $ES=0.239$). One of the most important reasons for the low level of vaccination in pre-clinical students can be the lack of information on the importance of vaccination, ignorance of the risk of HBV, the lack of communication with the patient in preclinical period, and so on. However, contact with HBV increases in preclinical years, so, it is better to perform vaccination among students of these fields when entering the university. For instance, in one study (30) conducted at Nigerian medical universities, 21.7% of the people exposed accidentally to blood were individuals who were studying in the preclinical course. In the present study, similar to other studies (14, 24, 31), there was no significant correlation between mean HBS-Ab titer with variables such as BMI, smoking, and type of blood group.

One of the constraints of this study was the lack of proportion to the size rule for selection of dental and medical students, as well as the assumption that all individuals who were born in 1993 and later received neonatal vaccination completely.

Table 4. Recommendations for hepatitis B vaccination for different categories of student healthcare workers in European countries (20).

country	Medical students	Nurses students	Paramedical students	Included in universal adolescent/ infant programs
Austria	R	R	R	Yes
Belgium	M	M	M	Yes
Czech Republic	M	M	M	No information
Denmark	N	N	N	Yes
France	M	M	M	Yes
Germany	R	R	R	Yes
Ireland	R	R	R	Yes
Italy	R	R	R	Yes
Poland	M	M	M	Yes
UK	R	R	R	No information
Spain	R	R	R	Yes

M, mandatory; R, recommended; N, neither mandatory nor recommended.

Conclusion

Since 55% of the students had a level of antibodies lower than the protective level (HBS-Ab < 10), Hormozgan University of Medical Sciences should conduct an HBS-Ab test for all dental and medical students and then perform one or more vaccine booster doses. Also, because of the low level of vaccination coverage among students in Hormozgan University of Medical Sciences (6.3%) compared to other universities, it is better to design a program based on which all students enrolled in the university receive hepatitis B vaccination upon entrance.

Informed Consent

Not applicable

Competing interests

The authors declare that they have no competing interests

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Authors' contributions

Study conception and design: PD, KN, HD. Data collection: KN, SSH. Data analysis and interpretation: KN, PD. Critical discussion and manuscript revision: PD, KN, SSH, HD, MHA. All authors read and approved the final manuscript.

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