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HEPATITIS B INFECTION AMONG WORKERS IN LABORATORY DEPARTMENT AT AL-JALAA HOSPITAL OFSURGERY AND ACCIDENTS: PREVALENCE, VACCINATION, AND IMMUNITY STATUS

Huda Mohamed*[1], Zahra Mohamed[1] , Ameena alsadek[1], Lamia abd-alwahed[1], Entesar abd-alhamed[1], Fatma El fargani[2], Nagwa Mohamed[2] and Bubaker Yaga[3]

[1]Department of Environmental Health - Faculty of Public Health - University of Benghazi –Libya.
[2]Department of Physiology. Faculty of Medicine. University of Benghazi- Libya.3 MD Emory University Neurostudies Department Atlanta GA, USA.

***Corresponding Author: Huda Mohamed**
Department of Environmental Health - Faculty of Public Health - University of Benghazi –Libya.

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ABSTRACT

Background: Hepatitis B is a life-threatening liver infection, and it is considered a global health problem because it leads to an increase in the mortality and morbidity rate as well as an economic burden. Materials and methods: This cross-sectional study was conducted in the laboratory department at Al-Jalaa Hospital of Surgery and Accidents. The data were collected by using a multiple-choice questionnaire as well as blood samples from the workers in the laboratory, to be tested for hepatitis B serology. The questionnaires were filled out by 46 workers and the blood samples were collected randomly from 20 workers, which included 18 laboratory technicians, 1 nurse, and 1cleaner. All these data were analyzed by SPSS software. Results: The results of the study showed that a large proportion of the sample had taken 2 doses of the hepatitis B vaccine and most of them considered the vaccine as being very effective. Most laboratory workers were aware that the hepatitis B virus was less dangerous than HIV, and they knew that they were at high risk from the former. Furthermore, this study revealed that 5% of thesample had chronic hepatitis B infection, while 50% of the participants had been vaccinated against hepatitis B infection. 8 of the participants had not been vaccinated against hepatitis B. These results showed a clear need for a vaccine. While the study did not find any relationship between vaccination status and workers' age, qualification level, and years of experience, it revealed a significant relationship between the participants and their gender. **Conclusion:** The vaccination policy must be implemented in all medical sectors and especially for those who have direct contact with blood samples and body fluids**.**

KEYWORDS: Hepatitis B, vaccination, healthcare workers, hepatitis B antigen.

INTRODUCTION

Hepatitis is liver inflammation; it affects liver function and causes damage to it. The most widespread hepatitis viruses are Hepatitis A, B, C (CDC, 2020), with the most common worldwide being hepatitis B virus HBV. Hepatitis caused by HBV can range from a moderate disease lasting a few weeks to a dangerous, lifelong disease (CDC, 2016).

About 2 billion people were infected with HBV worldwide (WHO,2009), and WHO reported that 257 million people had chronic hepatitis B infection. In 2015 there were about 887,000 deaths due to HBV because of associated cirrhosis and hepatocellular carcinoma (WHO, 2019). In 2016, the number of HBV-infected people was 27 million around the world, with 10.5% of them knowing their infection status, while 4.5 million (16.7%) of them were not aware of it, due to lack of symptoms (WHO,2019). In 2017, it was estimated that 1.1 million people were infected with hepatitis B, which led to high morbidity, due to lack of access to tests and treatment (WHO,2017).

Hepatitis B in its different stages and need for treatment harms people and society, leading to an increase in economic burden. Nemazee hospital in Iran experienced costs related to Hepatitis B diagnoses, treatment, and hospitalization as well as loss in missed workdays to an estimated $675, (Kavosi et al., 2014). Furthermore, the direct economic cost of chronic hepatitis B disease, including medication, doctor visits, and other associated treatments was estimated as being between $1,452 and $6,052. However, the indirect cost was $97 in Beijing and $741 in Guangzhou in China, and this financial loss associated with workers' days off, for each patient (Hu & Chen 2009).

The hepatitis B virus can remain outside the body for at

least 7 days (CDC, 2020). It can live on table-tops, razor blades, bloodstains, without losing infectivity (WHO,2002), and its incubation period is 75 days on average but can vary from 30 to 180 days. The virus may be discovered within 30 to 60 days after infection and can persist and develop into chronic hepatitis B (WHO, 2019).

Hepatitis B is diagnosed by a blood test that includes Hepatitis B surface antigen (HBsAg), Hepatitis B surface antibody (anti-HBs), total hepatitis B core antibody (anti-HBc), and IgM antibody to the hepatitis B core antigen (IgM anti-HBc) (CDC,2005).

This study aimed to evaluate the prevalence rate of hepatitis B infection and vaccination status among workers in the laboratory department at Al-Jalaa Hospital of Surgery and Accidents and assess their attitude regarding hepatitis B.

Materials and method

Study site: This study was conducted in the laboratory department at Al-Jalaa hospital of Surgery and Accidents, which includes hematology, serology, chemistry, microbiology, and blood bank.

Study design: The design of this study was descriptive, depending on the quantitative and cross- sectional approaches.

Method of data collection: The data was collected in two ways: the first way involved using a multiple-choice questionnaire and the second way was drawing blood samples from workers in the laboratory to test hepatitis B serology. All these data were collected from January to March 2020.

Questionnaire design: The questionnaire contains sixteen questions, including five of them that covered general information of technicians, namely gender, age, years of experience, educationallevel, and job type in the laboratory, and two questions about their knowledge regarding hepatitis B infection. There are also nine multiple-choice questions about hepatitis B severity, its method of transmission, the vaccine, and its evaluation (appendix A).

Target population and sample size: The target population was made out of workers in the laboratory department in Al-Jalaa Hospital of Surgery and Accidents, more exactly, 46 workers. Blood samples were collected from 20 participants, 3 of which worked in the blood bank, 4 in serology, 6 in the hematology department, 1 in the microbiology department, 5 in the chemistry department, and 1 in hospital cleaning. Furthermore, 27 questionnaires were filled by workers in the laboratory department.

Statistical analysis: The data were analyzed by statistical software package for social sciences (SPSS) version 22. The frequency and percentage were calculated. Also, The T-test was used to study the relationship between immunization and gender. The Kruskal Wallis test calculates the relationship between immunization and qualification level, years of experience, and workers' age.

Ethical consideration: This study was started after obtaining approval from the hospital director and obtaining permission from the laboratory officials.

Limitation: The limitation of this study was a delay in getting approval from the hospital director. Also, the research topic had been rejected by the laboratory official because the director felt that he would impose if he allowed the researchers to draw blood samples from the technicians. Another difficulty in accepting this topic was related to some technicians viewing it as a problem and possible personal exposure. In addition to the above, the cost of the blood testwas very high.

RESULT AND FINDINGS

Descriptive Analysis

Figure (3.1) Shows that a large proportion of the sample (92.6%) were laboratory technicians, while the other part were nurses and housekeeping, in equal distribution (3.7% each).

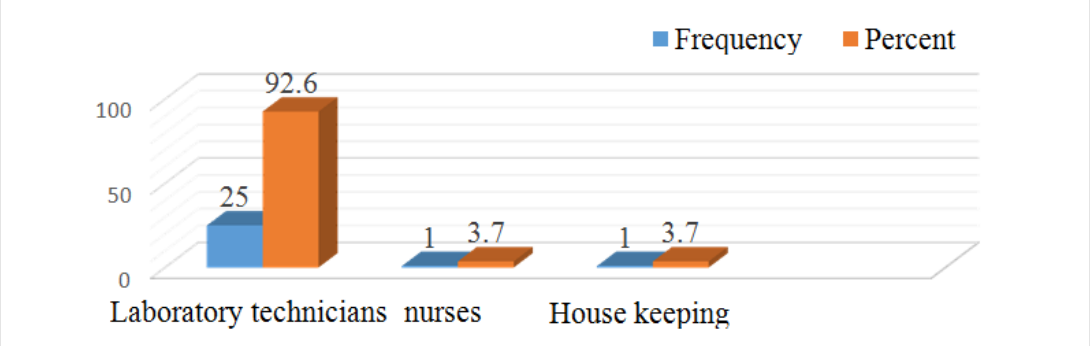

Figure 3.1: Job category of participants.

Figure 3.2 shows that more than half of the sample were females (85%) and 15% were males.

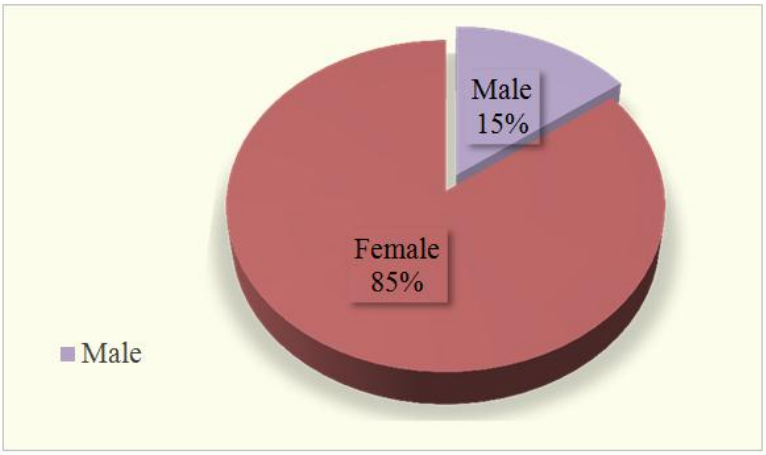

Figure 3.2 Frequency and percentage of gender distribution

Furthermore, Figure 3.3 represents the respondents' experience in terms of years. The largestsection (45%) were people with 40-49 years of experience, followed by 33% of respondents with 18-50 years of experience. The last two groups, each one of the 11%, were workers with 18 to 29 years of experience, and respectively above 50 years.

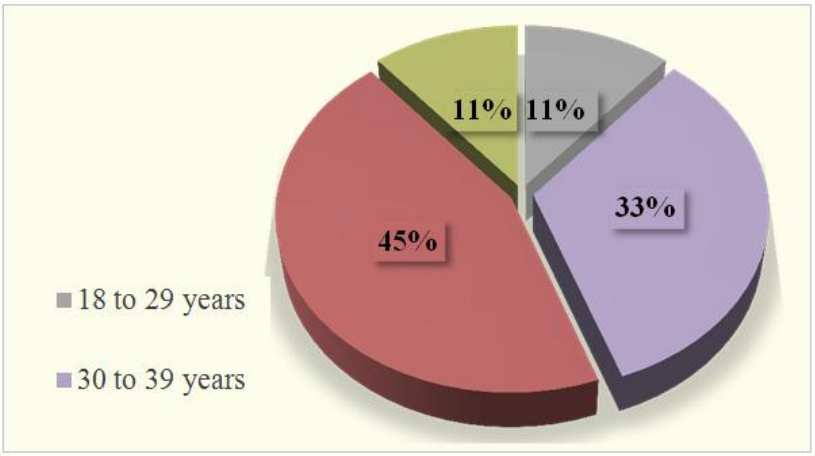

Figure 3.3: Frequency and percentage of age distribution.

Figure 3.4 shows that most respondents had a bachelor's degree (66%), followed by 26% with a diploma, and 4% with a master's degree.

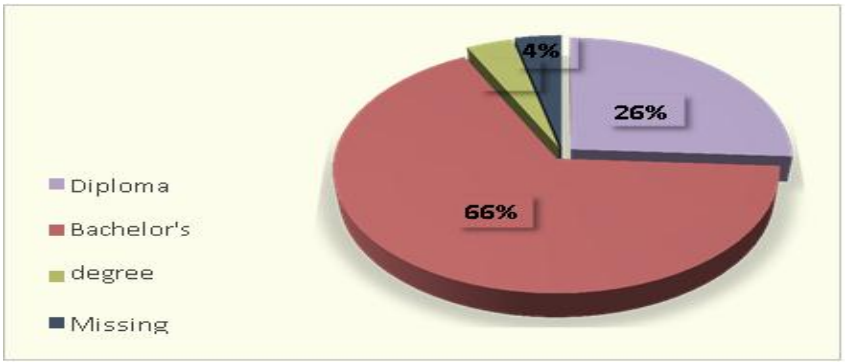

Figure 3.4 Frequency and Percentage of the level of the education distribution.

Figure 3.5 shows the highest percentages of participants with over 20 years of experience (41%),followed by 30% respondents with 3 to 10 years of experience, and 11% each 11 to 19 years and 6 months to 2 years of experience.

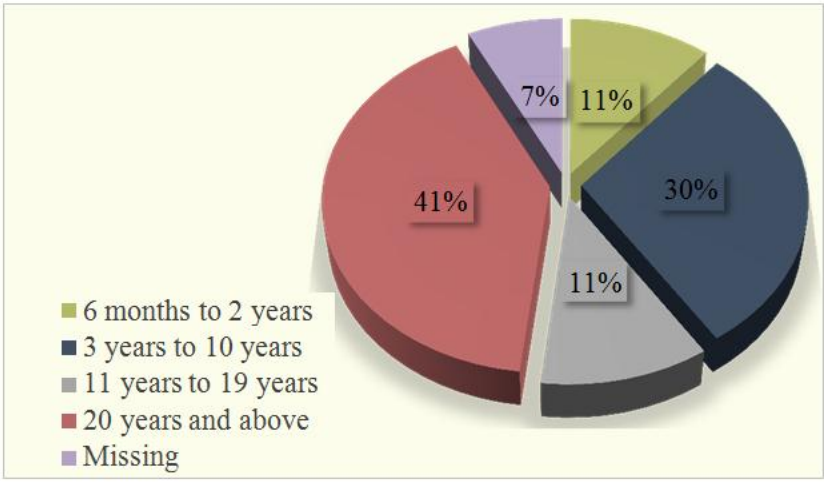

Figure 3.5 Frequency and percentage of years of experience distribution.

Besides, Figure 3.6 shows 22% of the sample had taken the hepatitis B vaccine.

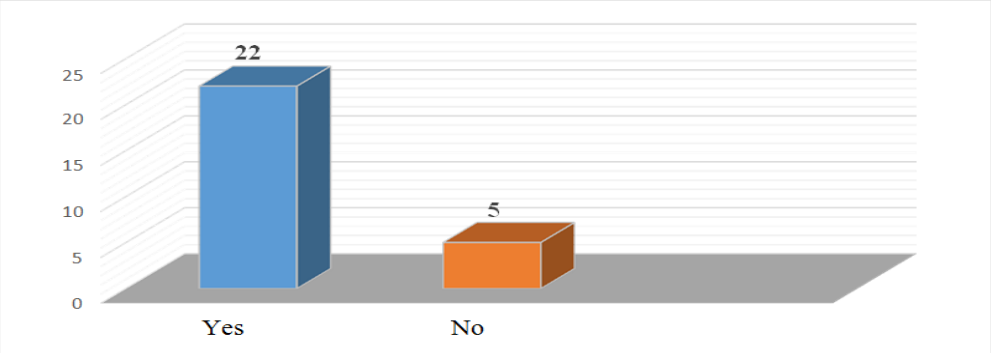

Figure 3.6: workers received hepatitis B vaccine.

Figure 3.7 shows that the highest proportion of the sample received 2 doses, while 18.5% ofthem took one dose and 14.8% received three doses.

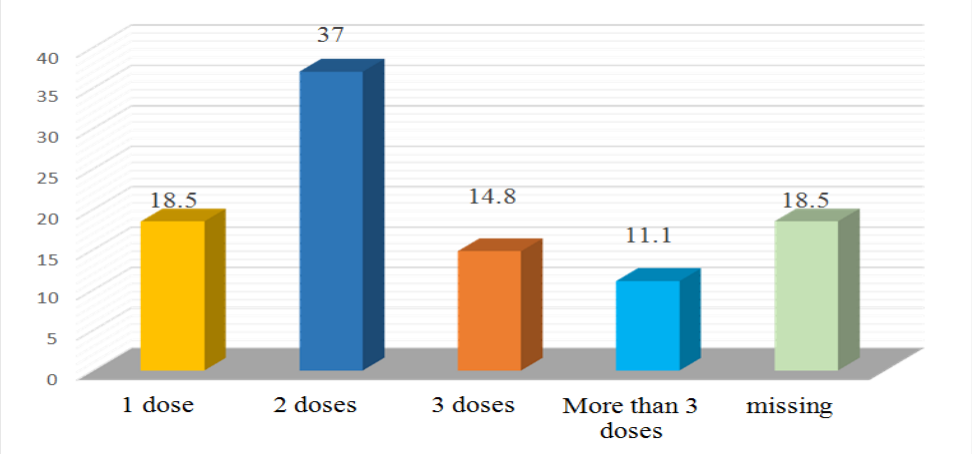

Figure 3.7: Number of vaccine doses that received by participants

Workers attitude about hepatitis B:
This study indicated that 81% of workers heard about hepatitis B infection, while 19% did nothear about it (See figure 3.8).

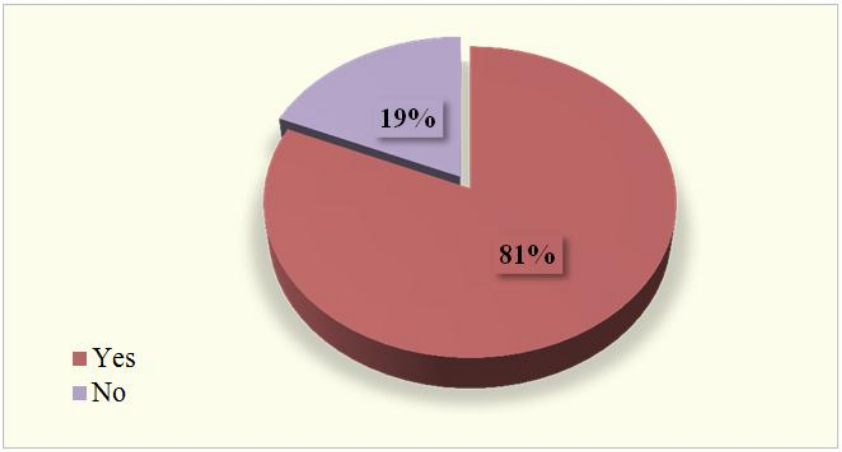

Figure 3.8: Workers heard about hepatitis B infection.

Figure 3.9 shows that most workers in the laboratory were aware that the hepatitis B virus was less serious than HIV (48%), and 29% of them thought that hepatitis B was as serious as HIV. 15% of respondents believed that hepatitis B was more serious than HIV and 4% did not know.

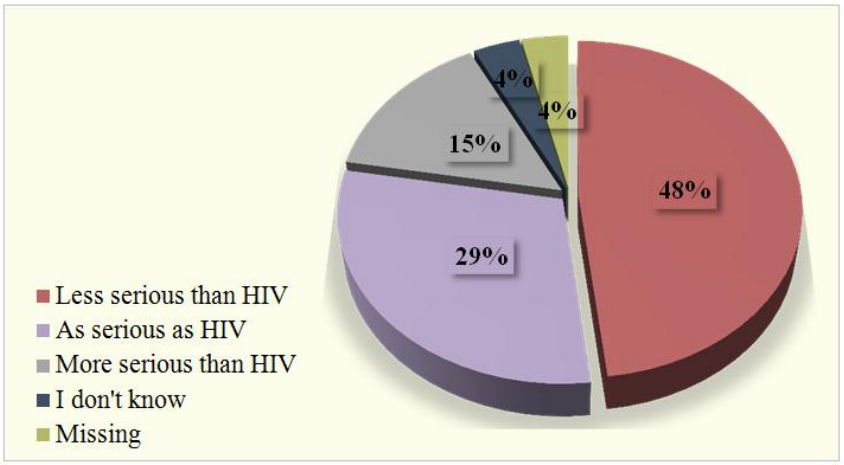

Figure 3.9: workers think about serious hepatitis B virus is compared to HIV.

Additionally, table 3.1 shows that 14.8% of workers in the laboratory department did not know the routes of hepatitis B transmission.

Table 3.1: hepatitis B transmission routes.

	Through contact with the blood ofan infected person	Through contact withthe saliva of an infected person	Through contactwith body fluid contaminated bythe blood of an infected person	I don't know	Total
Frequency	7	1	15	4	27
Percent	25.9	3.7	55.6	14.8	100

Furthermore, table 3.2 indicates that 40% of worker's health knew they were at high risk of exposure to hepatitis B infection, while 29.6% of them thought they were at moderate risk of exposure. 14.8% of the respondents thought that the risk of exposure with Hepatitis B was low and 3.7% of them had no opinion on the risk of exposure level.

Table 3.2: risk of contracting hepatitis B virus infection in the laboratory department.

	Low riskof exposure	Moderaterisk of exposure	High risk of exposure	I don't know	Missing	Total
Frequency	4	8	11	1	3	27
Percent	14.8	29.6	40.7	3.7	11.1	100

The highest proportion of participants (66.7%) were aware that the hepatitis B vaccination was very effective. 11.1 % of participants believed that the vaccination program was slightly effective, 7.4 % of them thought it was not effective and 11.1 did not know. (See table 3.3)

Table 3.3: What workers think regarding the effectiveness of hepatitis B vaccination in protecting someone against hepatitis B virus infection.

	Not effective	Slightlyeffective	very effective	I don'tknow	Missing	Total
Frequency	2	3	18	3	1	27
Percent	7.4	11.1	66.7	11.1	3.7	100

Figure 3.10 shows that a high proportion of health care workers (51.9%) were aware that the HB vaccine involves 3 doses. 33.3% of the healthcare workers didn't know the number of vaccine doses, and 7.4% of them thought that that vaccine included 2 doses.

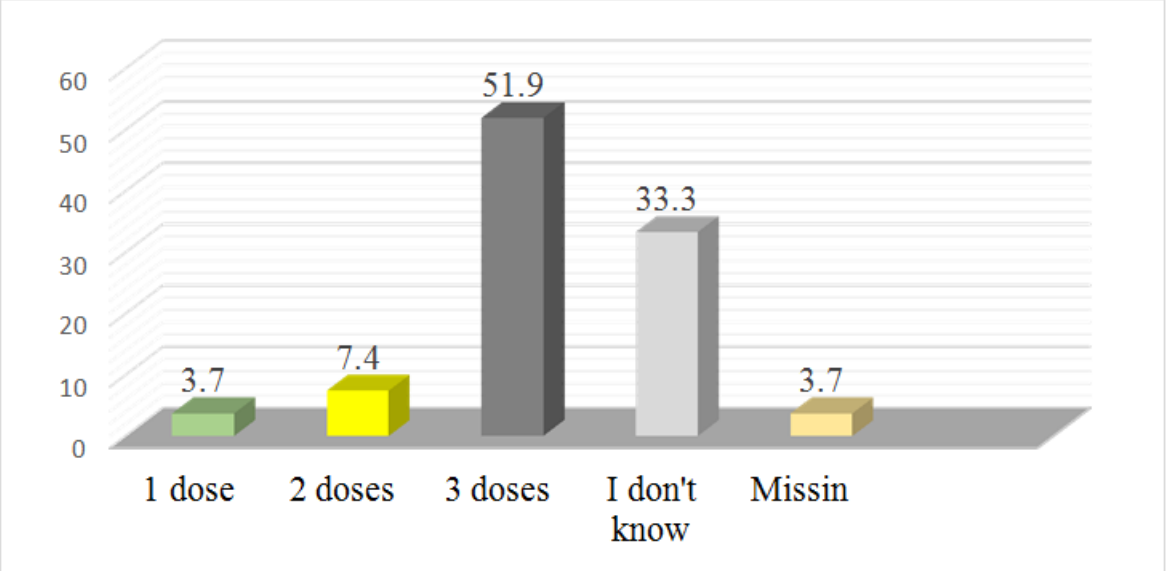

Figure 3.10: What workers think about the number of recommended doses of hepatitis Bvaccine.

HBV serological markers

According to the result of the HBV serological test, table 3.4 shows that one worker has a chronic infection (which represent 5% of the sample), 10 workers in the laboratory were vaccinated against hepatitis B infection, and 8 of the participants did not get vaccinated against hepatitis B (they need the vaccine).

Table 3.4: HBV infection status of HCWs from an Al-Jalaa Hospital of Surgery andAccidents.

HBV serological markers			No. (%)	Interpretation
HBsAg	Anti-HBs	Anti-HBc		
Positive	Negative	Positive	1	Chronic infection
Negative	Positive	Positive	0	Recovery from the previous infection
Negative	Positive	Negative	01	Immune (vaccinated)
Negative	Negative	Negative	8	Need vaccine
Negative	Negative	Positive	1	Repeat test

Regarding the hepatitis B antigen test, most of the workers in the laboratory department (90%) were negative for HBsAg. On the other hand, 5% of the sample was positive. (See figure 3.11).

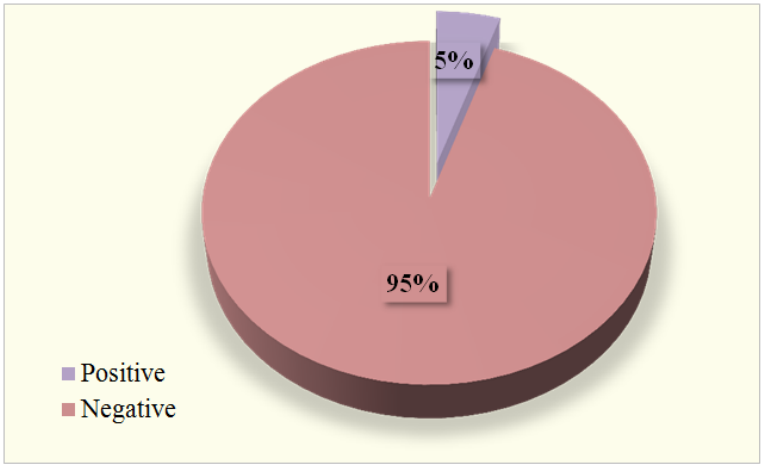

Figure 3.11: Prevalence of hepatitis B virus infection.

Furthermore, figure 3.12 shows that 50% of participants were vaccinated against HBV, while 50% of workers in the laboratory department were not vaccinated.

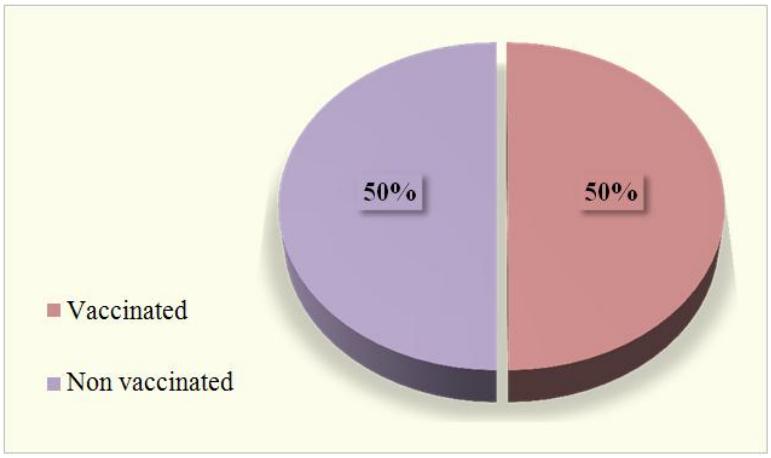

Figure 3.12 Vaccination status of workers in laboratory department at Al-Jalaa Hospital of Surgery and Accidents.

Figure 3.13 shows the vaccination status of participants according to gender. It shows that the highest percentage of workers who had received vaccination in the laboratory department (90%) were females, and only 10 % of the vaccinated workers were males.

Figure 3.13: Vaccination status of staff members at the laboratory of Al-Jalaa Hospital ofSurgery and Accidents according to gender.

Table 3.5 reveals that there is a statistical relationship between hepatitis vaccination and the gender of laboratory personnel because the p-value is less than 0.05.

Table 3.5: Results of T-test for examining the association between vaccination status ofworkers and gender.

	t	df	Sig. (2-tailed)
Gender	19.615	19	.000

Figure 3.14 shows the vaccination status of participants according to their level of education. The highest percentage of vaccinated workers (5 workers) had a diploma, followed by workers with a bachelor's degree, and workers with a master's degree.

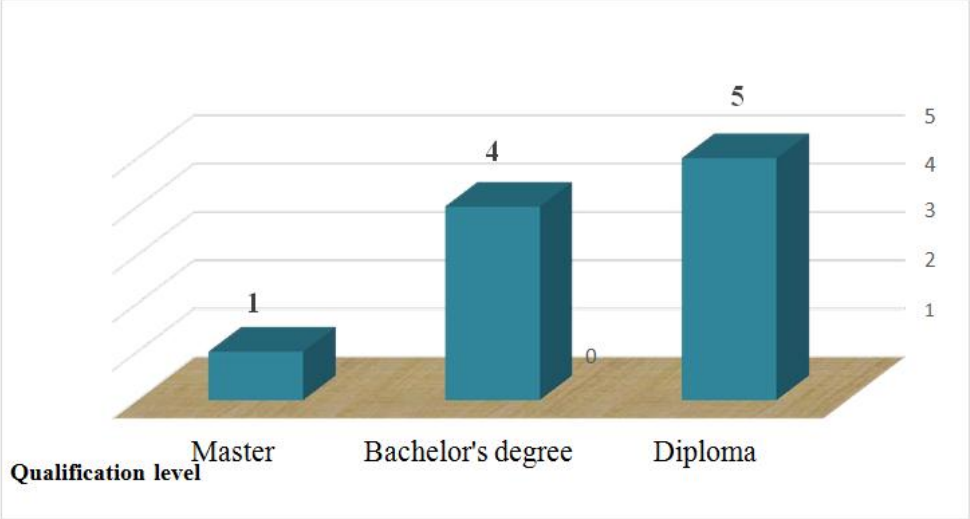

Figure 3.14: Vaccination status of staff members at the laboratory of Al-Jalaa Hospital ofSurgery and Accidents according to qualification level.

Table 3.6 shows that there is no statistical relationship between the hepatitis vaccination status ofworkers in the laboratory department and the level of the qualification because the P value was greater than 0.05.

Table 3.6: Results of Kruskal Wallis Test for examining the association between vaccination status of workers and qualification level.

	Chi-Square	df	Asymp. Sig.
Anti_HBs	4.700	2	0.095

Table 3.7 shows there is no statistical relationship between HB infection among workers in laboratory departments and their age because the P value was greater than 0.05.

Table 3.7: Results of Kruskal Wallis Test for examining the association between vaccination status of workers and workers' age.

	Chi-Square	df	Asymp. Sig.
Anti_HBs	1.500	3	.682

Table 3.8 shows that there is no relationship between HB infection among workers in the laboratory department at Al-Jalaa Hospital of Surgery and Accidents and years of experience because P-value is greater than 0.05.

Table 3.8: Results of Kruskal Wallis Test for examining the association between vaccination status of workers and their years of experience.

	Chi-Square	df	Asymp. Sig.
Anti_HBs	1.714	3	.634

DISCUSSION

Workers' attitude regarding hepatitis B infection

The present study found that most workers in the laboratory department are aware that the hepatitis B virus was less serious than HIV. It also showed that they had good knowledge regarding the routes of hepatitis B transmission. The highest percentage of the respondents were aware that hepatitis B was transmitted through contact with blood or bodily fluids contaminated by the blood of an infected person. Furthermore, it indicated that workers in the laboratory department knew that they were at high risk of infection with hepatitis B due to the nature of their work in the laboratory department. Moreover, workers believed that the hepatitis B vaccine was an effective way of protection against the infection with the virus.

The findings of this study were compared to other studies. A previously published study assessed the knowledge and attitudes of health care professionals concerning the risks associated with hepatitis B exposure and found that dental students did not have sufficient information about the transmission routes of hepatitis B, risk factors, and vaccine availability. Because of this lack of awareness among medical students, the latter felt uncomfortable in touching patients (Ali et al., 2017).

Furthermore, the largest number of participants had a positive attitude towards preventative measures for hepatitis B infection, which were sterilization of gloves, wearing tools, and receiving the vaccination against hepatitis B. It was also reported that most of the participants mentioned that the vaccination program was the most effective measure to prevent hepatitis B. In addition, more than half of the sample realize that sterilization was also important to prevent hepatitis B transmission as well as wearing gloves in the workplace (Mursy et al., 2019).

Another study showed that there was a significant lack of basic knowledge among health care professionals about hepatitis B transmission methods and preventative measures. It also indicated that hepatitis B composed a risk among health care workers when vaccination against

hepatitis B in health care is not common (Pham et. al., 2019).

Hepatitis B incidence

The present study reported that 5% of the workers in the laboratory department were infected with the hepatitis B virus. These workers had not been immunized before starting work and they may have been exposed to infection during the work period. This prevalence rate was fairly low when compared to other studies. According to Ziglam et al., (2013), the prevalence rate of hepatitis B infection among health care workers at the Tripoli Medical Center in Libya was 17.3% in 2013 (Ziglam et al., 2013).

Also, Khakhkhar et al. (2012) assessed the prevalence rate of hepatitis B among health care workers at tertiary care hospitals in India and found that the highest rate of hepatitis B prevalence was observed among laboratory technicians when compared to other job categories, which was 4.1% (Khakhkhar et al., 2012).

The present study indicated that 5% of the sample had a chronic infection. On the other hand, Mueller et al. found that 7% of health care workers had chronic hepatitis B infection at the Bugando Medical Center (BMC) in Mwanza, Tanzania in 2012 (Mueller et al., 2015).

The rate of hepatitis B prevalence was 10.0% among health care workers at Military Hospital located in Freetown, Sierra Leone in 2017 (Massaquoi et al., 2018).

Furthermore, CiorliaI & Zanetta indicated that the prevalence of hepatitis B infection in BrazilianUniversity hospitals in Brazil was 0.8% in 2005 (Ciorlia & Zanetta, 2005).

Additionally, Irfan et al. found that 99 participants in the study had a chronic infection in Virus Research Diagnostic Laboratory in the Department of Microbiology at Rajendra Institute of Medical Sciences, Ranchi, Jharkhand from 2013-2015 (Irfan et al., 2019).

Immunization status of health care workers

Vaccination is an important measure in preventing infection with hepatitis B virus for workers. This study found that 50% of laboratory workers were vaccinated and 50% were non-vaccinated in the laboratory department at Al-Jalaa Hospital of Surgery and Accidents in Benghazi, which seemed to signal a high level of vaccine awareness.

Furthermore, another study conducted in India found that 47.3% of workers were vaccinated, 20.8% did not complete the vaccine series, and 31.9% were not vaccinated (Jha et al.,2012).

The main reason for the low number of vaccinated workers in some hospitals could be insufficient vaccination coverage and lack of knowledge about hepatitis B and its prevention as well as vaccination policies in the hospital administration.

Besides, the percentage of workers who were completely vaccinated against hepatitis B in a tertiary hospital in Ethiopia was 28.7%. This was a very low percentage, and the reasons for that could be the lack of availability of vaccination and its high price (Ayalew & Horsa, 2017).

In contracts, a study that was conducted in two teaching hospitals in Nigeria reported that 36.2% of health care workers received all vaccine doses against HBV, while 65% of them received onlya single dose of immunization (Ogoina et al.,2011-12).

On the other hand, the number of vaccinated workers in the present study is considered low when compared to another study conducted at a tertiary care hospital in Tripoli, which indicated 72% of the workers being completely vaccinated. This reflects the worker's awareness to avoid hepatitis B infection by immunization. As a result, the vaccine should make it easier to obtain a high percentage of personnel who have been vaccinated (Ziglam et al., 2013).

Furthermore, another study in Isfahan in Iran showed that 62% of workers in the laboratory department were vaccinated, while 23.2% of them were not vaccinated. The study was conducted in laboratory clinical under approvement of Isfahan University of Medical Sciences (IUMS), Isfahan, Iran (Shoaei et al., 2015).

Immunization status of health care workers and its relation to gender

In this study, more than half of the sample was made out of females (85%) and (15%) were males at Al-Jalaa Hospital of Surgery and Accidents in Benghazi. Concerning the vaccination status of participants, this study found that the highest percentage of vaccinated workers in the laboratory department were females (90%), and the rest were males. In addition, the current study found a significant relationship between immunization and gender among laboratory personnel. This comes in agreement with another study in Seri Lanka, which reported a statistical relationship between immunization and gender, in which the females participants had a significantly higher immunized response (94.7%) than males (Chathuranga et al .,2013).

Besides, another study conducted in tertiary care hospital in Pakistan, studying the response of workers to the vaccine after completing the three doses, found a statistical relationship in the vaccination status between males and females. It was found that 18% of males were not any responders (Zeeshan et al., 2007).

Additionally, another study conducted in Nigeria, found that females were more vaccinated than males, and it found that males were more infected with hepatitis B

than females (Orji et al., 2020).

On the other hand, there is no statistical association between gender and hepatitis B infection serology of health care workers at the tertiary hospital of Peshawar, where the sample included 59.8% female and 40.2% Male (Attaullah et al., 2011).

Furthermore, another study that carried out tertiary care hospital in Tripoli, found that there was no association between males and females and vaccination status (Ziglam et al.,2013).

Immunization status of health care workers and its relation to workers' age

This study indicated that there was no statistical relationship between the HB Vaccination status of workers in laboratory departments and their Age. This came in agreement with another study carried out among health care workers at Enugu State University Teaching Hospital (ESUTH) in Nigeria, which is that the immunization status of workers did not have any association with workers' ages (Orji et al., 2020).

In contrast, another study conducted among primary health care workers at a tertiary hospital in Peshawar in Pakistan found a statistical relationship between workers' age and hepatitis Bimmunization (Attaullah et al., 2011).

Furthermore, another study in China found a clear association between workers' vaccination and their ages in 120 hospitals in China (in 2019). This study found that workers in the 25-29 and 30- 39 age groups received more than one dose of vaccine compared to other age groups (Yuan etal., 2019).

Immunization status of health care workers and its relation to workers' qualificationlevel

The present study indicated that the highest percentage of the vaccinated workers had a diploma in the laboratory department at Al-Jalaa Hospital of Surgery and Accidents. Also, it reported that there was no statistical relationship between the hepatitis vaccination status of workers in the laboratory department and the level of the qualification. This comes in agreement with another study conducted among health care workers in a tertiary hospital of Peshawar in Pakistan, which found no statistical association between worker's qualification levels and vaccination status, andit reported that nurses and technicians were at high risk to HBV infection (Attaullah et al., 2011). In addition, another study was carried out among workers in a Nigerian Tertiary Hospital. It indicated no statistical significance among the professional groups with different qualification levels and their vaccination status (Orji et al., 2020).

Another study, on the other hand, discovered a link between workers in basic health care and their educational levels in Northwest Pakistan. It was discovered that 75% of those who had been immunized were doctors (Yousafzai et al., 2014). In Ethiopia's teaching hospitals, 52 percent were nurses and 13.5 percent were doctors. (Akibu et al.,2018).

Immunization status of health care workers and its relation to years of experience

The present study found that there was no relationship between the hepatitis B vaccination status of workers and the years of experience in laboratory personnel at Al-Jalaa Hospital of Surgery and Accidents. This result confirms the findings of the previous study in Nigeria which found no relationship between the vaccination status of workers and their years of experience. However, it was observed that HCWs with experience of less than five years were more likely to have hepatitis B disease (Orji et al.,2020).

In contrast to this, another study carried out among health care workers in teaching hospital in Ethiopia, reported that the years of work experience and infection-prevention training had a positive relationship with complete vaccination status, which found that participants with ≥5 years of work experience had 3 times greater chance of receiving the vaccine than others (Akibu et al., 2018). In addition, another study was conducted at the University of Nigeria Teaching Hospital (UNTH) in Eungue and concluded that only years of occupational practice had a significant association with vaccination status (lbekwe & lbeziako,2006)

CONCLUSION

This study found that half of the participants were aware that the hepatitis B virus is less serious. It also indicated that the highest proportion of workers in the laboratory department knew that the hepatitis B virus can be transmitted through contact with bodily fluids contaminated by the blood of an infected person. Additionally, most health care workers knew that the hepatitis B vaccination program involved 3 doses. Also, a high proportion of participants knew that hepatitis B vaccination was very effective in preventing this infection.

Besides, this study indicated that 90% of workers, were negative for hepatitis B antigen while 5% of the sample was positive. Also, this study found that 50% of workers were vaccinated, 40% were not vaccinated, and 5% had chronic hepatitis B infection. Moreover, it reported that 14.8% of workers have taken three doses of the hepatitis B vaccine.

Additionally, it found a significant association between gender and vaccination status of a worker, which is illustrated by the highest percentage of workers who had received vaccination in the laboratory department being female.

Besides, it did not find any statistical relationship between HB vaccination among workers and their years of experience, age, and educational level.

REFERENCE

1. Akibu, M., Nurgi, S., Tadese, M. and Tsega, W.D., 2018. Attitude and vaccination status of healthcare workers against hepatitis B infection in a teaching hospital, Ethiopia. Scientifica, 2018.
2. Ali, A., Khan, S., Malik, S. M., Iqbal, M. H., & Aadil, M., 2017. Comparison of knowledge and attitudes regarding hepatitis B among healthcare professionals in Pakistan. Cureus, 9(2).
3. Attaullah, S., Khan, S., Ayaz, S., Khan, S.N., Ali, I., Hoti, N. and Siraj, S., Prevalence of HBV and HBV vaccination coverage in health care workers of tertiary hospitals of Peshawar, Pakistan. Virology journal, 2011; 8(1): 1-5.
4. Biset Ayalew, M., & Adugna Horsa, B., Hepatitis B vaccination status among health care workers in a tertiary hospital in Ethiopia. Hepatitis Research and Treatment, 2017.
5. Centers for Disease control and prevention, Interpretation of Hepatitis B serologic Test Result-CDC.avaliable from https://www.cdc.gov/serologicharttv8, 2005.
6. Centers for disease control and prevention, Hepatitis B General information. Available form https://www.cdc.gov/hepatitis/HBV/PDFs/HepBGeneralFactSheet.pdf, 2016.
7. Chathuranga, L.S., Noordeen, F. and Abeykoon, A.M.S.B., Immune response to hepatitis B vaccine in a group of health care workers in Sri Lanka. International Journal of Infectious Diseases, 2013; 17(11): 1078-e1079.
8. Ciorlia, L. A., & Zanetta, D. M., Hepatitis B in healthcare workers: prevalence, vaccination and relation to occupational factors. Brazilian Journal of Infectious Diseases, 2005; 9(5): 384-389.
9. Hang Pham, T. T., Le, T. X., Nguyen, D. T., Luu, C. M., Truong, B. D., Tran, P. D., & So, S., Knowledge, attitudes and medical practice regarding hepatitis B prevention and management among healthcare workers in Northern Vietnam. PloS one, 2019; 14(10): e0223733.
10. Hu, M., & Chen, W. Assessment of total economic burden of chronic hepatitis B (CHB)- related diseases in Beijing and Guangzhou, China. Value in health, 2009; 12: S89-S92.
11. Ibekwe, R.C. and Ibeziako, N., Hepatitis B vaccination status among health workers in Enugu, Nigeria. Nigerian Journal of Clinical Practice, 2006; 9(1): 7-10.
12. Irfan, S., Gupta, M. D., Sahu, N. P., Bhuttoo, Z. A., & Kumari, P., Experience with Hepatitis B Viral load Testing in Jharkhand. Arch Hepat Res, 2019; 5(1): 009-016.
13. Jha, A. K., Chadha, S., Bhalla, P., & Saini, S., 2012. Hepatitis B infection in microbiology laboratory workers: prevalence, vaccination, and immunity status. Hepatitis research and treatment, 2012.
14. Kavosi, Z., Zare, F., Jafari, A., & Fattahi, M. R. Economic burden of hepatitis B virus infection in different stages of disease; a report from southern iran. Middle East journal of digestive diseases, 2014; 6(3): 156.
15. Khakhkhar, V. M., Thangjam, R. C., Parchwani, D. N., & Patel, C. P., Prevalence of hepatitis B virus infection in health care workers of a tertiary care hospital. Nat J Med Res, 2012; 2(2): 176-178. ISO 690.
16. Massaquoi, T.A., Burke, R.M., Yang, G., Lakoh, S., Sevalie, S., Li, B., Jia, H., Huang, L., Deen, G.F., Beynon, F. and Sahr, F., Cross sectional study of chronic hepatitis B prevalence among healthcare workers in an urban setting, Sierra Leone. *PloS one*, 2018; *13*(8): e0201820.
17. Mueller, A., Stoetter, L., Kalluvya, S., Stich, A., Majinge, C., Weissbrich, B., & Kasang, C., Prevalence of hepatitis B virus infection among health care workers in a tertiary hospital inTanzania. BMC infectious diseases, 2015; 15(1): 386.
18. Mursy, S. M. E. M., & Mohamed, S. O. 0., Knowledge, attitude, and practice towards Hepatitis B infection among nurses and midwives in two maternity hospitals in Khartoum, Sudan. BMC public health, 2019; 19(1): 1597.
19. Ogoina, D. I. M. I. E., Pondei, K., Adetunji, B., Chima, G., Isichei, C., & Gidado, S., Prevalence of hepatitis B vaccination among health care workers in Nigeria in 2011–12. Int J Occup Environ Med (The IJOEM), 2014; 5(1 January): 362-51.
20. Orji, C.J., Chime, O.H. and Ndibuagu, E.O., Vaccination status and prevalence of hepatitis B virus infection among health-care workers in a tertiary health institution, Enugu State, Nigeria. Proceedings of Singapore Healthcare, p.2010105820923681, 2020.
21. Shoaei, P., Najafi, S., Lotfi, N., Vakili, B., Ataei, B., Yaran, M., & Shafiei, R. Seroprevalence of hepatitis B virus infection and hepatitis B surface antibody status among laboratory health care workers in Isfahan, Iran. Asian journal of transfusion science, 2015; 9(2): 138.
22. World health organization. Hepatitis B. Available online at https://apps.who.int/iris/bitstream /handle/10665/67746/WHO_CDS_CSR_LYO_2002.2_HEPAT ITIS_B.pdf;jsessionid=AA18839F0724DC04980123891CA49028?sequence=1, 2002.
23. World health organization, weekly epidemiological Record Hepatitis B vaccine. Available form https://www.who.int/wer/2009/wer8440.pdf, 2009.
24. World Health organization, New hepatitis data highlight need for urgent global response. available from https://www.who.int/news-room/detail/21-04-2017-new-hepatitis-data-highlight- need-for-urgent-global-response, 2017.
25. World health organization, Hepatitis B. Available form https://www.who.int/en/news- room/fact-sheets/detail/hepatitis-b, 2019.
26. Yousafzai, M.T., Qasim, R., Khalil, R., Kakakhel, M.F. and Rehman, S.U., Hepatitis B vaccination among primary health care workers in Northwest

Pakistan. International journal of health sciences, 2014; 8(1): 67.
27. Yuan, Q., Wang, F., Zheng, H., Zhang, G., Miao, N., Sun, X., Woodring, J., Chan, P.L. and Cui, F. Hepatitis B vaccination coverage among health care workers in China. PloS one, 2019; 14(5): e0216598.
28. Zeeshan, M., Jabeen, K., Ali, A.N.A., Ali, A.W., Farooqui, S.Z., Mehraj, V. and Zafar, A., Evaluation of immune response to Hepatitis B vaccine in health care workers at a tertiary care hospital in Pakistan: an observational prospective study. BMC infectious diseases, 2007; 7(1): 120.
29. Ziglam, H., El-Hattab, M., Shingheer, N., Zorgani, A., & Elahmer, O., Hepatitis B vaccination status among healthcare workers in a tertiary care hospital in Tripoli, Libya. Journal of infection and public health, 2013; 6(4): 246-251.Available online at https://www.sciencedirect.com/science/article/pii/S1876034113000336.