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Prevalence of Hepatitis B vaccination coverage among dental students and academic staff in Al_Mustaqbal University

A Research Project
Submitted to the College of Dentistry, Al_mustaqbal University in Partial Fulfillment of the Requirements for the B.D.S. Degree in Dentistry

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بِسْمِ اللَّـهِ الرَّحْمَـٰنِ الرَّحِيمِ

﴿ وَأَنْ لَيْسَ لِلْإِنسَانِ إِلَّا مَا سَعَى ﴾

صَدَقَ اللهُ العَلِيُّ العَظِيمْ

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Dedication

We dedicate this project to all of our family members. It would not be possible to complete it without their support. In addition, to our close friends who poured us with confidence and faith to believe that we can do it.

Finally, we want to thank our self for reaching this stage and continuing with courage and steadfastness.

Acknowledgment

First, we would like to thank God Almighty for our inspiration for energy, patience and strength to accomplish this work. A special peace to our Messenger Muhammad (may God bless him and grant him peace). Our sincere appreciation to **(Prof.Dr. Athraa Yehya Mohammed)** (Dean of the College of Dentistry) for her high ethics and for lasting help.

Thank you very much to our supervisor **(Prof.Dr.Saad Hasan Mohammed Ali),** we would like to express our gratitude for scientific care and encouragement, especially his advice that lights our way, we thank everyone who helped us in the search for the scientific truth.

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Abbreviations	Meaning
ALT	Alanine Aminotransferase
CHB	Chronic Hepatitis B infection.
cccDNA	covalently closed circular DNA
CDC	Central of disease control
EMR	Eastern Mediterranean Region
HAV	Hepatitis A virus
HBV	Hepatitis B virus
HCV	Hepatitis C virus
HDV	Hepatitis D virus
HGV	Hepatitis G virus
HBIG	Hepatitis B immune globulin
HBeAg	Hepatitis B virus E antigen. HBcAg
HBsAb	Hepatitis B surface antibody (anti-HBs/HBsAb)
HBcAb	Hepatitis B core antibody
HBeAb	Hepatitis B envelop antibody
HBcAb IgG	Hepatitis B core antibody immunoglobulin G
HBcAb IgM	Hepatitis B core antibody immunoglobulin M
HBsAg	Hepatitis B surface antigen.
HCC	Hepatocellular carcinoma

HBcAg	**Hepatitis B virus core antigen.**
IDUs	**Intravenous drug users**
NTCP	**sodium taurocholate cotransporting polypeptide**
Pg-RNA	**pregenomic RNA; HBV**
RT-PCR	**Reverse transcriptase-polymerase chain reaction.**
rcDNA	**Relaxed circular DNA.**
WHO	**World health organization**

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Abstract:

Background: Dental educational institutions represent a unique biological hazard environment due to frequent exposure to blood, saliva, and sharp instruments. Despite the availability of effective vaccination programs, the level of immunity against Hepatitis B among dental students and academic staff remains an important public health concern. Assessing vaccination coverage and immunity status is essential for reducing occupational risk.

Objectives: This study aims to evaluate the rates of Hepatitis B vaccination among dental students and academic staff and to analyze the association between academic stage and vaccination status. Additionally, the study examines the time elapsed since the last vaccine dose to estimate the potential immunity gap.

Methods: A cross-sectional analytical study was conducted at Al-Mustaqbal University, College of Dentistry and Dental Technology on 125 participants. There were stratified into Academic Dental Staff (n=20), newly graduated dentists (n=16), 5^{TH} year Students (n=61), 4^{TH} year students (n=19), and dental technicians responders (n=9). Data regarding vaccination status, number of vaccine doses received, and time since the last vaccination were collected using a structured questionnaire. Statistical analysis was performed using Chi-square (X^2) tests to evaluate associations between variables.

Results: The findings revealed a significant heterogeneity in vaccine receivers ($P < 0.001$). 5^{TH} year dental students and dental academic staff

demonstrated a higher vaccination rate (48.8% and 16%) respectively, compared with 4Th year dental students (15.2%) and dental technicians 7.2%. There were 65.6% female from all responders while males' percent were 33.6%.

Conclusion: Although vaccination against Hepatitis B is widely recognized as an essential preventive measure for healthcare workers, gaps in vaccination coverage and potential waning immunity still exist among dental students and academic staff. These findings highlight the importance of strengthening institutional vaccination policies and promoting booster dose awareness to maintain adequate protection against occupational exposure.

Keywords: Hepatitis B, Dental Education, Vaccination Coverage, Occupational Risk, Immunity Gap.

Chapter one:

Introduction

Chapter 1:

1.1 Introduction

The disease described as “jaundice” in ancient Greek, Roman, and Chinese literature probably was viral hepatitis. A viral etiology was postulated as the cause of certain forms of jaundice as early as 1912, and the term “infectious hepatitis” was used because the disease often occurred in epidemics (Cockayne et al, 1912).

Hepatitis has been a major plague of mankind. The history of the discovery of causative viruses is one of the most fascinating scientific adventures of this half century. Individualization of several types of hepatitis only emerged after world war two. Their identification has been associated with milestones, which revolutionized medicine and public health. The discovery of HBV brought the first ever vaccine not prepared by tissue culture but initially directly from plasma and soon the first vaccine produced by genetic engineering (Trepo, 2013).

There are 5 main strains of the hepatitis virus, referred to as types A, B, C, D and E. While they can all cause liver disease, they differ in important ways including modes of transmission, severity of the illness, geographical distribution and prevention methods (Bernal *W. et al, 2013)*.

A number of new hepatitis viruses (G, TT, and SEN) were discovered late in the past century. Hepatitis G virus (HGV), disclosed in the late 1990s, has been rather well studied. Analysis of many studies dealing with HGV mainly suggests the lymphotropicity of this virus (Ivanovich et al, 2008).

HBV and HCV infections are particularly concerning as they can develop into chronic conditions potentially leading to liver cirrhosis and cancer (Sayed IM et al, 2023).

Viral hepatitis was first identified as an occupational hazard for health care workers more than 60 years ago. For the past few decades, hepatitis B has been one of the most significant occupational infectious risks for health care providers. With the increasing prevalence of hepatitis C infections around the world, occupational transmission of this flavivirus from infected patients to their providers has also become a significant concern. Several factors influence the risk for occupational blood-borne hepatitis infection among health care providers such us, types and frequencies of parenteral and mucosal exposures to blood and blood containing body fluid, and whether the patient or provider has been immunized with the HBV vaccine (Huizen et al, 2025).

Prevention of hepatitis B virus (HBV) transmission from infected mothers to their newborns is critical to HBV control and eventual eradication. Mother-to-child perinatal transmission causes the highest chronic carrier rate (>85%) with a high rate of subsequent chronic liver disease and hepatocellular carcinoma. This risk is reduced by 90% with HBV vaccine given along with hepatitis B immune globulin (HBIG) starting at birth. New analyses data from United State trials of HBIG and HBV vaccine in high-risk infants revealed better efficacy with yeast-recombinant vaccines (Stevens et al, 2017).

Aims of study

This study aims to assess the prevalence of hepatitis B virus vaccination coverage among dental and technical staff and students in Al-Mustaqbal University, and evaluate the awareness, attitudes, and preventive practices related to Hepatitis B infection of these staff and their compliance with the recommended immunization protocols and preparedness for future public health challenges.

Objectives

Specific Objectives

1-preparation of formats for hepatitis B vaccination in relation to their vaccine specific distribution and doses.

2- Verify age, gender, academic profession and work location within Al-Mustaqbal University (Faculty of Dentistry or Department of Dental Technology).

Chapter Two:

Literature Review

Chapter 2: Literature Review

Hepatitis is an inflammatory condition of the liver that can be acute or chronic. It is most commonly caused by viral infections, including hepatitis A, B, C, D, and E viruses, although non-viral causes such as alcohol abuse, drugs, toxins, and autoimmune disorders may also lead to liver inflammation. therefore, hepatitis can significantly impair overall health(MMWR Surveill Summ, 2019).

Clinical manifestations range from asymptomatic cases to symptoms such as fatigue, anorexia, nausea, abdominal pain, and jaundice(Rev Med Liege ,2014).

Chronic hepatitis, particularly hepatitis B and C, may progress to liver cirrhosis, liver failure, or hepatocellular carcinoma. Hepatitis remains a major global public health problem, emphasizing the importance of prevention, early diagnosis, and appropriate management (MMWR Surveill Summ , 2014).

Autoimmune hepatitis (AIH) results from the destruction of hepatocytes as the result of the imbalance between proinflammatory cells and immunosuppressive cells, especially the imbalance between Tregs and Th17 cells (Zhou Yuming et al ,2024).

In addition, genomeic analyses suggested that HLA genes including HLA-DRB*0301, HLA-DRB*0401, and HLA-B*3501 as well as non-HLA genes including CD28/CTLA4/ICOS and SYNPR increased AIH susceptibility. Recent evidence has demonstrated the pathogenic role of E. Gallinarum and L.reuteri in inducing autoimmunity in the liver (Hepatology, 2022)

2.1 Hepatitis A

2.1.1 Epidemiology :

Due to improved living conditions and subsequent changes in hepatitis A epidemiology, the disease burden of hepatitis A is increasing in many regions. Recently, Korea has faced a large, community-wide outbreak of hepatitis A, which has prompted a vaccination program (J. Med Virol, 2010).

2.1.2 clinical manifestations:

Hepatitis A virus (HAV) is a positive-strand RNA virus that is transmitted feco-orally through person-to-person contact(Hepatology ,2018) . The clinical spectrum of hepatitis A virus infection ranges from asymptomatic infection to fulminant hepatitis(J. Med Virol , 2010).

Infection is often asymptomatic in children, but adults present with jaundice, abdominal pain, hepatitis, and hyperbilirubinemia (Hepatology ,2018) .

2.1.3 Hepatitia A Vaccine :

Hepatitis A continues to cause sporadic cases, epidemics, and occasional deaths in the United States. A killed virus vaccine for immunization against hepatitis A has recently been approved by the Food and Drug Administration (Amj Gastroenterol, 2016). .One hundred percent seroconversion occurs after a series consisting of a primary dose and a second booster shot 6-12 months later (MMWR Morb Mortal Wkly Rep et al , 2019).

Co-administration of immune-globulin and hepatitis A vaccine lowers ultimate antibody levels 50% compared with vaccine alone. Targets for immunization will probably be children, international travelers, military personnel, and food handlers. It will also be useful for general vaccination in areas where smoldering epidemics occur. Natural immunity levels in the United States population have undergone a significant decline since 1980 and are currently in the 21-33% range. Prescreening for immunity is likely to be cost-effective in persons over age 40 (Southeast Asian J Trop Med Public Health, 2000).

2.2 Hepatitis B virus (HBV).

2.2.1 Structure:

As showing in figure 2, HBV is a partially double-stranded DNA virus of 3.2 kilobases, and it transforms from pregenomic ribonucleic acid (RNA) to DNA by reverse transcription during its life cycle. The genome consists of an outer lipid envelope and inner nucleocapsid core encoded by four overlapping open reading frames, named C, X, P, and S (McNaughton et al. 2019).

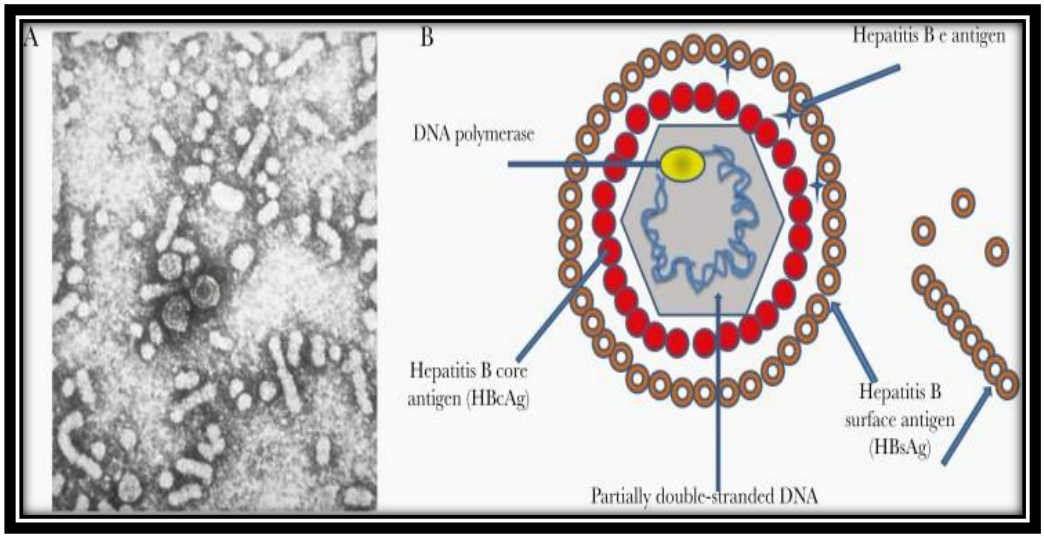

Figure 2.*1* A_ Electron micrograph of hepatitis B virus (HBV), B_ Dane particles (43 nm) and spherical and tubular surface antigen particles (22 nm) (Damme P et al, 2017).

Although it is known as a virus with high replication ability, due to the absence of the proofreading reverse transcriptase enzyme, the naturally occurring mutations may arise in different genome regions (figure 2.2),which may encode for polymerase, surface antigen, core/precore promoter, and X genes, which then significantly influence HBsAg expression and progression of HCC (Arikan et al. 2019).

Additionally, due to the complete overlapping of *pol* and *S* genes, drug resistance and nucleoside resistance mutations occurring in the *pol* gene can lead to changes in its product HBsAg (Kırdar et al. 2019).

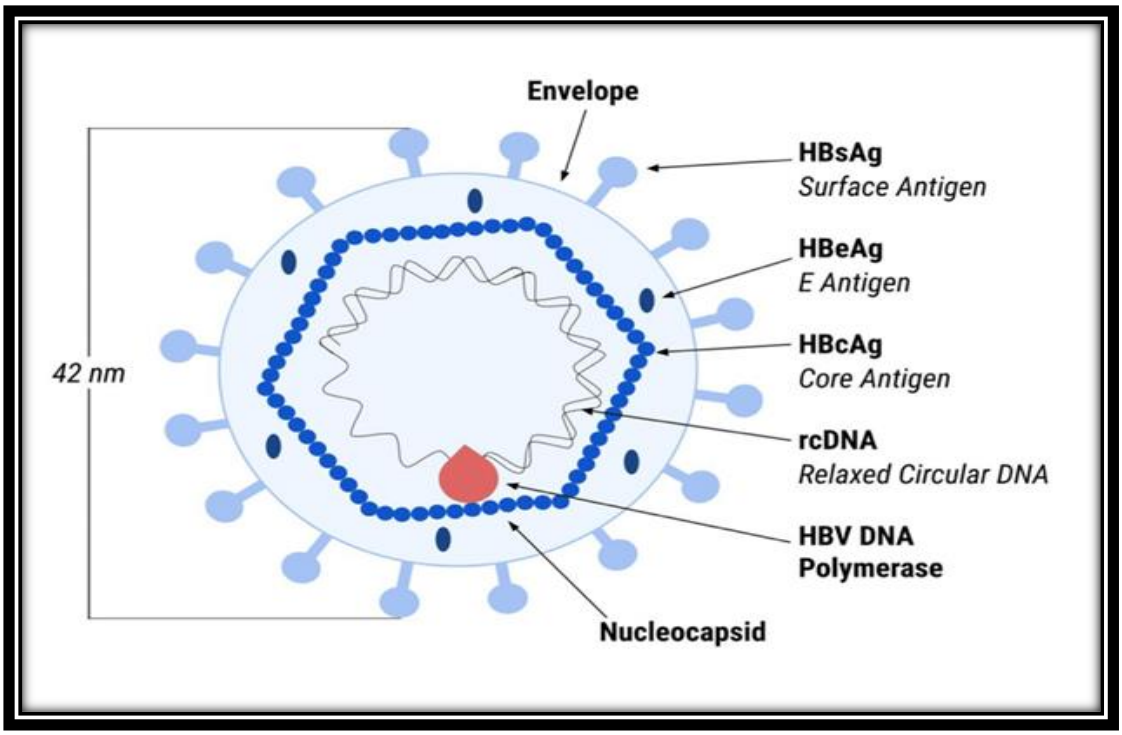

Figure 2.2 HBV structure: HBV: hepatitis B virus; HBeAg: hepatitis B virus E antigen; HBsAg: hepatitis B surface antigen; HBcAg: hepatitis B virus core antigen; rcDNA: relaxed circular DNA (Naidu et al, 2025).

2.2.2 HBV Replication Cycle:

The unique replication cycle of HBV is important to understand how covalently closed circular DNA (cccDNA) is formed. The replication cycle of HBV begins as the viral capsid binds to the bile acid transporter, sodium taurocholate cotransporting polypeptide (NTCP), on the surface of a hepatocyte, and the HBV virion is internalized through receptor-mediated endocytosis (Figure *2.3)*.

The viral capsid travels through the cytoplasm to the nuclear pore. A small, partially double-stranded, rcDNA is released in the nucleus. RcDNA is then converted into cccDNA, which become chromatinized. CccDNA is the template for the transcription of all HBV RNAs, each of

which encodes for specific antigens used to build HBV. The resulting capsids are either enveloped at the multivesicular body (MVB) within the cell and released as new virions, or transported back to the nuclear pore to increase the reservoir of intracellular cccDNA (Wei L et al, 2021).

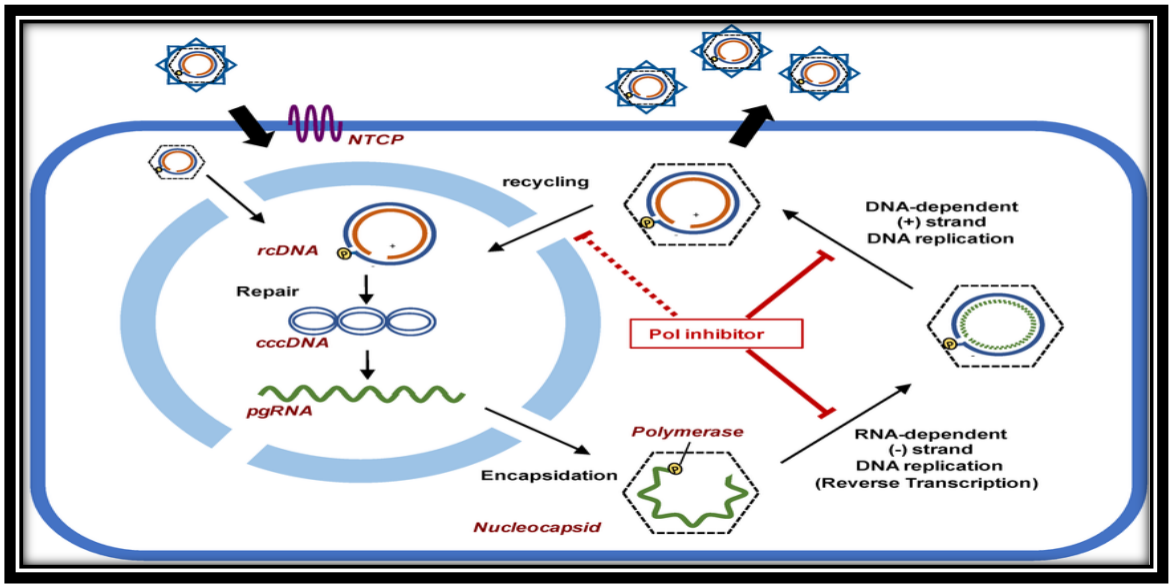

Figure 2.3: The lifecycle of hepatitis B virus (HBV) focusing on viral genome replication. HBV polymerase has several crucial roles in viral replication. Polymerase inhibitors block the reverse transcription pathway, namely RNA-dependent minus-strand DNA synthesis; they also block DNA-dependent plus-strand DNA synthesis, thereby suppressing the recycling step for cccDNA amplification (ohsaki et al, 2021).

2.2.3 The global genotype distribution of HBV:

Global distribution of HBV differs in different geographic regions and areas worldwide. HBV is classified into 10 genotypes (A-J) and 40 sub-genotypes until today, according to the phylogenetic analysis. Genotype A is predominant in Northwest Europe, North America, and Africa; genotypes B and C prevail in East Asia and Far East countries,

while genotype D is widespread worldwide. Genotype E occurs only in West Africa (Ambachew et al. 2018).

Genotype F has been found in Central and South America, and genotype G has been reported in Turkey, France, Canada, Vietnam, Germany, and America. Genotypes H and I have been isolated in Central America, Mexico, Vietnam, and Laos; the recently identified genotype J has only been found in Japan. HBV genotypes and sub-genotypes have been reported to effectively affect disease transmission, progression, and treatment outcome. Therefore, identifying HBV mutations and genotypes is essential for both disease manifestation and identification of individuals at risk of infection progression (Paudel et al, 2019).

In Iraq, many studies were conducted to determine the epidemiological status of the disease, considering that Eastern Mediterranean Region (EMR) countries have intermediate Endemicity of HBV with carrier rates of 2% to 5% in their general population. In Basrah, a study on blood donors in 2013 showed that of them had serological evidence of HBV 2.3% infection and another one in Babylon governorate showed a sero-prevalence of 0.7% and in general Iraqi population is 1.6% (Al-Kaif et al, 2022).

In Thi-Qar Blood Bank from 2020-2021, the prevalence of HBV was around 0.14% with urban showing slightly higher rates than rural as showing in figure2.4 (Entedar A et al, 2023).

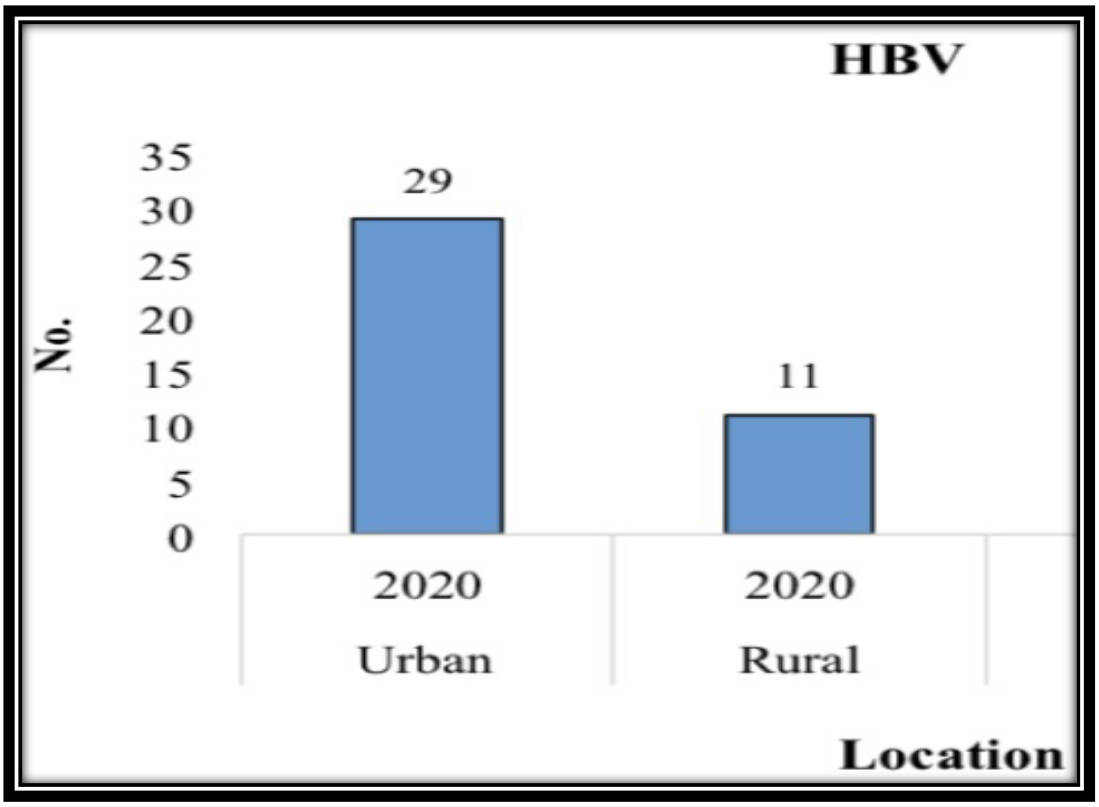

Fig 2.4: The Distribution of Hepatitis B Virus infection according to the place of residence during 2020 (Entedar A et al, 2023)

2.2.4 Rate of HBV infection:

The rate of HBV infection also differs in geographic regions. According to the HBsAg positivity, the prevalence of HBV infection is classified into low (< 2), low-intermediate (2–4.9%), high intermediate (5–7.9%), and high (≥ 8). HBsAg is of the main concern, especially for the Western Pacific regions with 6.25 seropositivity (Kim et al. 2018).

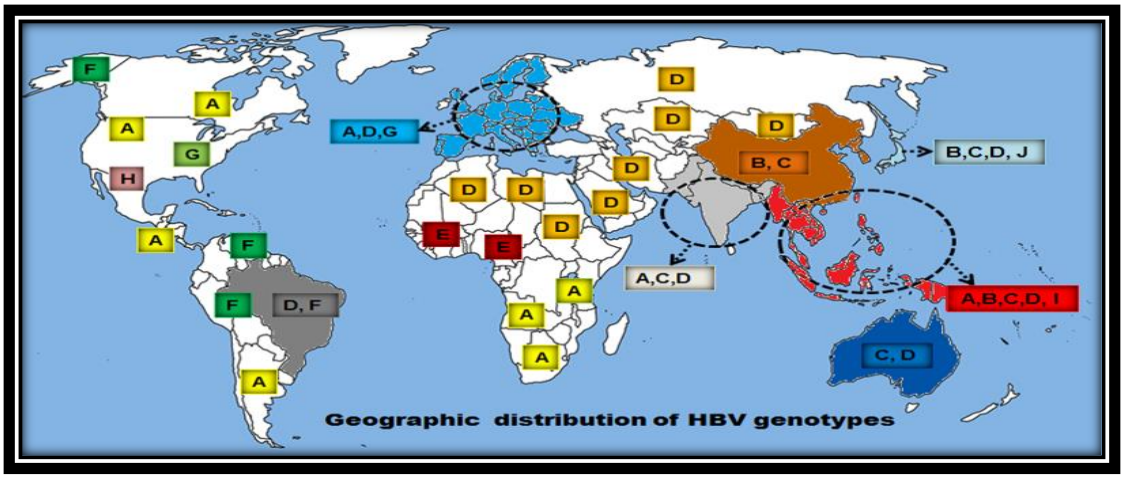

Figure 2.5 Distribution hepatitis B virus genotypes (A-J) worldwide (Hussain, 2018).

RT-PCR was used to determine the highest viral load in Iraqi infected subjects of and then used for screening HBV genotype, the results showed that genotypes C, A, B and D percentage as follows (8.5 %, 5%, 4.3%, and 2.1% respectively) (Al-Kaif et al, 2022).

2.2.5 Clinical manifestation of HBV infection:

Infection with hepatitis B virus (HBV) can cause acute and chronic hepatitis B infection (CHB). Infections with HBV are frequently asymptomatic and often only detected when people are screened or tested for other reasons. The World Health Organization (WHO) estimated in 2019 that 296 million people worldwide lived with CHB and that only 10.5% of these individuals were aware of their infection. Progression of CHB can lead to severe liver disease with outcomes such as cirrhosis

and liver cancer occurring in 20–30% of chronically infected individuals (WHO, 2021).

The global prevalence of CHB infection in the Eastern Mediterranean Region, South-East Asia Region, and European region is estimated at 3.3%, 2.0%, and 1.6% respectively as shown in Fig. 2.6 (WHO, 2019).

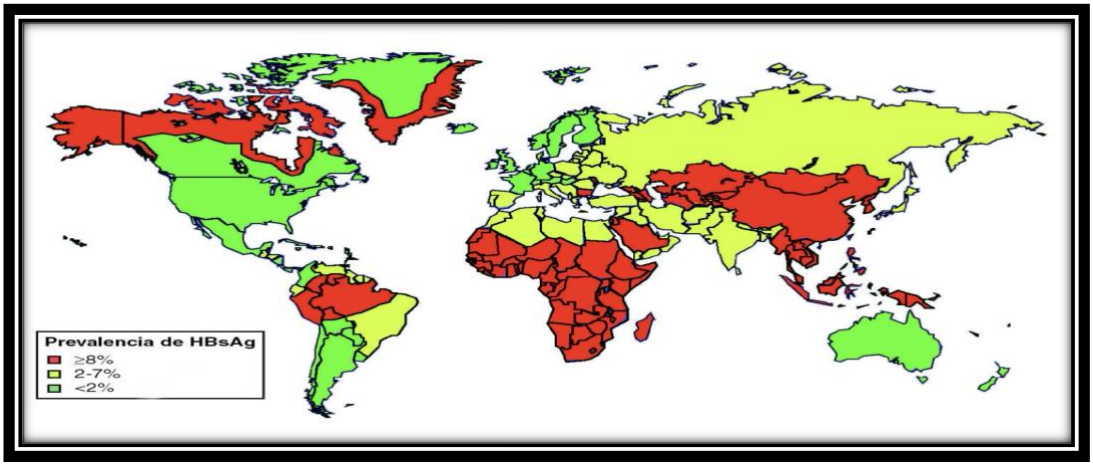

Figure 2.6 Global prevalence of chronic hepatitis B infection (WHO, 2019).

2.2.5.A: Signs and Symtoms of acute HBV infection:

Patients infected with HBV could be asymptomatic initially and , depending on particular genotype, might not be symptomatic throughout infection state. The incubation period of HBV infection is typically between 30 to 180 days. However, when symptomatic form acute HBV infection, patients can present with serum sickness-like syndrome manifested like fiver, rash, arthralgia, arthritis, fatigue, abdominal pain, nausea, anorexia, and Patient's syndrome usually subsides with the onset of jaundice (Nishant T. et al, 2023).

2.2.5.B. Chronic manifestation:

2.2.5.B. First: Immuno-tolerance:

Immunotolerance is an outdated term and is being replaced by other terms such as: chronic infection with high replication; low inflammation; or simply HBeAg+ “chronic infection“ ”.Immunotolerance ”in patients with CHB was formerly described as HBeAg positivity، high viral replication often with serum HBV-DNA levels $>10^{6-7}$ IU/ ml، persistently normal ALT، and no or minimal evidence of liver disease on histopathology. One explanation for such condition can be due to ineffective antigen processing and transport to major histocompatibility complex I receptors leading to HBV-specific T cell hypo-responsiveness In addition; HBV is able to remain undetected and spread. It was assumed that the adaptive immune response plays a significant role in the pathogenesis of liver disease or viral clearance rather than the innate immune response (yang G et al, 2022).

2.2.5. B. Second: Reactivation:

Hepatitis B virus reactivation (HBVr) is the loss of immune control in patients with CHB or as in case of immunocompromised/immunosuppressed patients with resolved HBV, where Immunosuppression implicated includes treatments for malignancy, inflammatory bowel disease,

rheumatologic diseases or stem cell transplantation (Attar B.M, 2020).

Regarding HBVr ,diverse manifestations were reported including(Myint A, 2020):

1- Elevated viral load without clinical signs of hepatitis described as silent activation.

2-Clinical/biochemical/histological evidence of hepatitis (HBV hepatitis), OR

3- Hepatic synthetic dysfunction with coagulopathy and

encephalopathy described as (fulminant) liver failure, which can result in liver transplantation or death.

2.2.6 Transmission of HBV:

The main modes of transmission of HBV are vertical transmission and horizontal transmission (sexual transmission, and parenteral contact with blood or blood products). This hepatotropic virus is highly stable at 37 °C on environmental surfaces for more than 22 days. HBV is detected in blood and body fluids such as saliva, tears, sweat, semen, and vaginal secretions of infected individuals. Most hepatitis B cases in low prevalence areas are attributed to injection drug use and high-risk sexual exposures (Sabeena et al, 2022).

2.2.6. A. Vertical transmission:

Vertical transmission of HBV is defined as transmission occurring during pregnancy and in the perinatal period from the HBV-infected mother to the foetus or to the child, resulting in positivity at 6-12 month of life of the hepatitis B surface antigen (HBsAg) or HBV DNA in infants. Overall, vertical transmission of HBV is a high efficacy phenomenon ranging, in the absence of any preventive interventions, from 70% to 90% for hepatitis e antigen (HBeAg) positive mothers and from 10% to 40% for HBeAg-negative mothers. Most vertical transmissions occur at or near the time of birth while intrauterine infections take place in < 15percentage of pregnancies (Veronese , 2021).

2.2.6.B Horizontal transmission:

Horizontal transmission of hepatitis B virus (HBV) is a significant transmission route in households, among contact sport athletes and institutionalized individuals. Children often are infected by non-sexual close contacts with an increased tendency to become chronic carriers. Hence, the awareness about various high-risk behaviours leading to horizontal transmission in the community is essential. (Sabeena et al, 2022).

2.2.6. B. First: sexual transmission:

Several studies have shown that sexual transmission has become the most common route of acute HBV infection among unvaccinated adults in the world. Through follow-up investigation and comparative analysis, Hou et al. found that heterosexual contact was the

main way of HBV transmission among adults in Taiwan. Sun found that the spouses of HBsAg positive patients had a higher positive rate of HBsAg than that of controls (13.21% vs 6.29%), reported that heterosexual transmission played an increasing role in HBV infection. However, the long-term impact of sexual transmission on the HBV infection in China remains unclear (Inoue and Hou et al, 2021).

2.2.6. B. Second: Parental/percutaneous transmission:

Hepatitis B virus infection is one of the serious challenging blood-borne occupational hazards among health care workers (WHO, 2017). They are exposed to a higher risk of blood-borne pathogens and other body fluids, such as saliva, menstrual, vaginal, and seminal fluids, during their routine health care services. The exposure might be a result of needle stick injuries, contamination with an infected patient's blood, a splashing of blood or other body fluids into the eyes, nose or mouth, or blood contact with non-intact skin (Esposito S, 2021).

Transmission of hepatitis B virus (HBV) and hepatitis C virus (HCV) is similar regarding the mode of transmission and related risk factors. Therefore, it is not rare to encounter dual HBV/HCV infection in populations at risk of parenteral exposure to hepatitis viruses (Liu et al, 2021).

2.2.7 Laboratory diagnosis of hepatitis B virus:

Initial assessment of HBV infection begins with patient history, physical examination, evaluation of liver disease activity, and

interpretation of different hepatitis markers. Their combinations such as HBsAg, HB core antigen (HBcAg), HBeAg, HB surface antibody (anti-HBs/HBsAb), HB core antibody (anti-HBc), anti-HBc IgM, and HB e antibody (anti-HBe) (Jade Pattyn et al, 2021).

Table 2.1: Interpretation of Serologic Test Results for Hepatitis B

	Acute HBV	Chronic HBV	Cleared HBV	Vaccination
HBcAb IgM	+	−	−	−
HBcAb IgG	+	+	+	−
HBsAg	+	+	−	−
Anti-HBs	−	−	+	+
HBeAg	+	+/−	−	−
Anti-HBe	−	+/−	+/−	−
HBV DNA	High/low	Low/high	−	−

Abbreviations: HBcAb IgG, hepatitis B core antibody immunoglobulin G; HBcAb IgM, hepatitis B core antibody immunoglobulin M; HBeAg, hepatitis B e antigen; HBsAg, hepatitis B surface antigen; HBV, hepatitis B virus(Jade Pattyn et al, 2021).

2.2.8 Prevention:

The majority of new HBV infection was prevented through both vaccination and effective interruption of the transmission. Because more than 90% of new HBV infection is al-ready prevented by vaccination, it

would be difficult to encounter new dual HBV/HCV infection in the young vaccinated generation. This expectation was first validated in certain risk populations such as those positive for human immuno-deficiency virus (HIV) infection or intravenous drug users (IDUs) (Lin J-J,2021).

Risk Group Stratification (Rawaa Behlul et al, 2025).

a. Healthcare workers (stratified by occupation and patient contact level).

b. Patients undergoing surgical procedures.

c. Blood donors.

d. Pregnant women.

e. Pre-marital screening participants.

f. High-risk occupational groups (barbers, traditional birth attendants).

g. Contacts of diagnosed patients.

2.4.8. A. Vaccine:

However, persistent HBV infection can lead to varying degrees of liver damage, leading to various complications such as hepatitis, fibrosis, cirrhosis, and hepatocellular carcinoma (HCC), causing nearly 900,000 deaths every year. The anti-HBV vaccine has been available to people since 1982 (WHO,2019).

The hepatitis B vaccination program achieves exceptional effectiveness, with a calculated rate of approximately 94.73-95%. The substantial reduction in HBsAg prevalence among vaccinated individuals underscores the critical importance of neonatal

vaccination in HBV-endemic regions (Saraceni c. et al, 2021) (Jarrahi et al, 2025).

A study estimated that a timely scale-up of the birth dose vaccine to 90% by 2030 would immediately reduce the incidence of chronic HBV, and the number of deaths in the global population born between 2020 and 2030 will be reduced by 710,000 (de Villiers MJ,2021).

Studies have shown that hepatitis B vaccine (HepB) is an economically attractive option compared to other interventions, but it has not reached universal coverage worldwide, with global coverage remaining at only 42% by 2021. Between 1990 and 2020, 310 million people worldwide have benefited from hepatitis B vaccination and were protected from hepatitis B virus infect (Zhang LL, 2019).

The corresponding vaccination program are varies from one country region to another, the World Health Organization (WHO) encouraged vaccination campaigns based on the specific prevalence of hepatitis B antigen carriers in the geographic area (WHO, 2019). Therefore, several vaccination protocols and different doses, have been proposed. The use of adjuvants and a booster dose has demonstrated the ability to enhance the immunological protection properties of the HepB vaccine (Di Lello FA, 2022).

The anti-HBs titers of two accelerated vaccination schedules for high-risk healthy adults ,, 0-7-21 days and 0-1-2-12 months, were confirmed to have the capacity of reaching seroprotective levels more rapidly than the standard group. However, where the effectiveness and the safety of the hepatitis B vaccine varied among different populations even if the same HepB strategy is used since the effectiveness of immunization is affected by different individual characteristics. In addition, genome-

wide association studies have shown that some genes with associated single nucleotide polymorphisms (SNPs) play a key role in HepB response in different populations (Chung S, 2019).

Moreover, it has also been suggested that, the impact that different metabolic states (e.g. diabetes, obesity, etc.) may have disorders of innate immunity that can negatively affect vaccine response (Hyer RN,2019).

In 1990s saw the introduction of the HBV vaccination in Iraq, which was intended for high-risk individuals and babies. Although vaccination has greatly decreased the prevalence of HBV in children, limited public awareness, bottlenecks in vaccine supplies, and restrictions in healthcare infrastructure make it difficult to achieve high coverage (Rawaa Behlul et al, 2025)

2.2.8. B. Behavior Modification:

Changes in sexual practice and improved screening measures of blood products have reduced the risk of transfusion-associated hepatitis. Behavior modification is thought be more beneficial in developed countries than in developing countries, where neonates and children in early childhood are at the greatest risk of acquiring infection. In these group, immunoprophylaxis, both passive and active, will be more effective (Lkeda K et al, 2023).

2.2.9 Treatment:

Currently, there is no specific antiviral treatment recommended for persons with acute hepatitis B disease as approximately 95% of infected immunocompetent adults recover spontaneously. Specific treatment is available to support people with chronic HBV infection. The

main goal of the available care is to maintain comfort, relieve symptoms, and prevent patients from passing the infection to others (Jade Pattyn et al, 2021).

FDA-approved treatments:

Currently, several medications have been approved for the treatment of CHB: two subcutaneous interferon (IFN)-based drugs were FDA approved, and as follows [interferon alpha (INF-α), pegylated interferon (Peg-INF),tenofovir alafenamide (TAF), and tenofovir disoproxil (TDF) and seven oral nucleos(t)ide analogs (NUC)] (Ogunnaike M et al, 2023).

2.3 Hepatitis C virus (HCV)

2.3.1 Epidemoiology:

Hepatitis C virus (HCV) infects an estimated 170 million persons worldwide and thus represents a viral world epidemic.one that is five times as widespread as infection with the human immunodeficiency virus type 1 (HIV-1). The institution of blood-screening measures in developed countries has decreased the risk of transfusion-associated hepatitis to a negligible level, but new cases continue to occur mainly as a result of injection-drug use and, to a lesser degree, through other means of percutaneous or mucous-membrane exposure,(Frank et al ,2000).Progression to chronic disease occurs in the majority of HCV-infected persons, and infection with the virus has become the main indication for liver transplantation. HCV infection also increases the number of complications in persons who are coinfected with HIV- 1 (Alter MJ et al ,2000)

HCV is endemic in most parts of the world. There are, however, considerable temporal and geographical variations in the incidence and prevalence of infection. In contrast to the USA, where the National Health and Nutrition Examination Survey found that almost 2% of the population were HCV antibody-positive (MJ Alte,2020), no study of HCV in an unselected population has been performed in the UK. Estimates based on studies of low-risk groups, such as blood donors and antenatal women, suggest a prevalence of up to 0.5% in the general population. In contrast, a large study of injecting drug users in England and Wales found an overall prevalence of 30%, with rates of up to 70%in those who had injected over the longest period (Hepatitis C strategy for England, Department of Health ,2002).

In a prospective study, incorporating five centres within the Trent region of England, found that HCV was most common among young adults, over half of whom had been born in the 1960s or later, and reported a male: female ratio of 2:1. This age and sex distribution is typical of injecting drug users (IDU), and theTrent study confirmed that IDU was the most common risk factor for infection. Approximately 50% of all infections were associated with HCV genotype 1, but a significant correlation was found between genotype 3 and infection by IDU. The second major risk factor for HCV in that study was receipt of blood components (AH Mohsen, Trent HCV Study Group , 2000).

2.3.2 Common symptoms of HCV infection:

Hepatitis C virus (HCV) is a positive strand RNA virus that belongs to the Hepacivirinae genus within the Flaviviridae family. HCV infection has a wide spectrum of cellular tropism and clinical

presentations. Consequently, a wide range of clinical consequences characterises this viral infection, including asymptomatic chronic carriage, acute hepatitis, chronic hepatitis, cirrhosis, hepatocellular carcinoma and extrahepatic manifestations. The latter are commonly observed and may represent the first sign of the disease. A better knowledge of the pathobiology of HCV and its clinical consequences will be important for developing better treatment strategies to cure HCV infection and extrahepatic manifestations (F. Zoul et al ,2020).

2.3.3 Transmission of HCV:

Transmission is primarily through exposure to infected blood. Risks for transmission include blood transfusion before 1992, intravenous drug use, high-risk sexual activity, solid organ transplantation from an infected donor, occupational exposure, hemodialysis, household exposure, birth to an infected mother, and intranasal cocaine use (Henriot P et al ,2022) According to the U.S. Centers for Disease Control and Prevention (CDC), the most common risk factors for acute HCV infection in the U.S. from 1991-1995 were high-risk drug (60%) and sexual behaviors (20%). Other modes of transmission (occupational, hemodialysis, household, and perinatal) accounted for approximately 10% of infections (Schreiber G.B. et al ,2020) (Dodd R.Y et al ,2022).

2.3.4. Vaccine :

An effective vaccine is the only means to prevent HCV infection and diminish HCV-related disease burdens, including HCC. Current approaches for vaccine candidate vehicles include synthetic peptides, DNA, recombinant viral vectors, virus-like particles (VLPs) and Potential epitopes from E1 and E2. It is also important to determine if a preventive

vaccine can act therapeutically to reverse immune dysfunction and protect from re-infection as Direct-Acting Antivirals (DAAs) are modern antiviral drugs used for the treatment of Hepatitis C virus (HCV) infection. These agents act by directly targeting specific viral proteins that are essential for the HCV life cycle, thereby inhibiting viral replication within hepatocytes.(Liang et al ,2021) cure does not restore HCV immunity (Walker et al ,2017)

The absence of an immunocompetent small animal model for vaccine evaluation against HCV infection is a critical block in the field. The moratorium on experimentation with chimpanzees that went into effect more than 10 years ago put a stop to the use of the only viable animal challenge infection model for HCV vaccine development, leaving researchers with limited options for testing (Liang et al ,2021).

2.4 Hepatitis D

Hepatitis D infection is caused by the Hepatitis D virus (HDV), a single stranded, enveloped RNA molecule. HDV is the smallest virus known to infect humans, and it is often classified as a subvirus given that the HDV lifecycle is entirely dependent on HBV (Rizzetto M et al, 1997).

HDV is a 1.7kb single stranded RNA molecule that encodes for the hepatitis D antigen (HDAg). Depending on RNA processing, the HDAg has one of two forms—the short form (HDAg-S) or long form (HDAg-L)—each with distinct functional roles. HDAg-S activates further HDV RNA synthesis, while HDAg-L inhibits HDV RNA synthesis and promotes HDV assembly with HBsAg to allow for packaging and transport(Farci P et al, 2018).

2.4.1 Epidemiology:

There are multiple estimates of HDV prevalence, as high as 13% of all HBV carriers; however, a recent meta-analysis estimated that approximately 4.5% of HBsAg-positive people are coinfected with HDV which corresponds to approximately 12 million HDV infections worldwide(Stockdale AJ et al, 2020).

Regardless of geography, the populations at highest risk for HDV include people who inject drugs and those with human immunodeficiency virus (HIV) or (HCV). HDV is even more prevalent in patients with HBV associated cirrhosis and HCC, highlighting the pathogenic importance of HDV (Stockdale AJ et al, 2020).

2.4.2 HDV Transmission and nature of infection:

The primary mode of transmission occurs in way similar to HBV and can occur either at the same time as an HBV infection (i.e., co-infection) or in patients with chronic HBV infections (i.e., super-infection). This relationship to HBV infection timing determines the natural history of HDV infection (Farci P et al, 2018).

2.4.3 Prevention:

Since, HDV infection and replication is entirely dependent upon HBV infection, and therefore HDV prevention efforts are largely centered around HBV prevention with vaccination programs.

Which have led to a significant reduction in HDV infections in developed countries (Rizzetto M, 2015).

The only currently available treatment for HDV is interferon, which may exert its effect on HDV either via direct inhibition of HDV or inhibition of HBV(Asselah T et al, 2020).

2.5 Hepatitis E (HEV):

2.5.1 Etiology of HEV:

Hepatitis E is caused by the Hepatitis E virus (HEV), a single-stranded, quasi-enveloped RNA virus of the Hepeviridae (is a family of viruses that includes the Hepatitis E virus (HEV), which causes Hepatitis E, an acute viral liver disease (smith DB et al ,2020)Viruses in this family are non-enveloped, have a positive-sense single-stranded RNA genome, and are mainly transmitted through the fecal–oral route, especially via contaminated water (Dalton et al ,2018). Eight genotypes have been identified, with genotypes 1–4 being the most studied (Meng et al ,2021). HEV infection usually results in an acute, self-limiting hepatitis, but severe disease may occur in pregnant women, and chronic infection has been reported in immunocompromised individuals (petal et al ,2024)

2.5.2 Common Symptoms of HEV infection:

Acute viral hepatitis typically presents with several non-specific but common symptoms: Fatigue and malaise, nausea and vomiting, jaundice, dark urine, abdominal pain usually in the upper right quadrant,

mild to moderate fever, loss of appetite,and pale stools (clay-colored due to blocked bile flow) (Aggarwal et al, 2021).

2.5.3 Transmission of HEV:

A. Food-borne / Zoonotic: HEV-3 to HEV-8 infect humans via contact with animals or consumption of contaminated meat (pavlíkova et al ,2023)

B. Water-borne: Fecal-contaminated water is a major route; HEV1 and HEV2 are transmitted via the fecal–oral route

(Aggarwal et al , 2020). HEV RNA found in sewage suggests possible transmission even in developed areas (Kamar et al ,2022).

C. Blood / Organ Transplantation: HEV-3 and HEV-4 can be transmitted via blood products and organs, especially risky for immunosuppressed recipients (Harvala et al, 2022).

D. Vertical Transmission: HEV-1 and HEV-2 cause severe pregnancy outcomes whereas vertical transmission of HEV-3 and HEV-4 confirmed in animals; HEV RNA detected in placenta, umbilical cord, and breastmilk (Khuroo et al , 2021).

2.5.4 Vaccine:

In 2010, a vaccine against HEV1 (Hecolin), based on the ORF2 protein, was Evaluated in a phase 3 trial in China with over 100,000 participants (Zhu et al ,2020). Long-term follow-up (>4 years) showed only 60 HEV cases, seven in the Vaccinated group, with no serious vaccine-related adverse events. The vaccine is Assumed protective against HEV1

and HEV4, but its efficacy for HEV3 is Unknown (Lu et al ,2024). Phase 1 trials are ongoing for HEV3 endemic regions, with phase 2 and 3 trials expected. Additionally, a large trial is testing Hecolin in over 20,000 Pregnant women in Bangladesh to assess safety and efficacy in this high-risk group (zaman et al , 2020)

2.6 The G hepatitis viruses (HGV) or Hepatitis GB Virus (HGBV).

2.6.1 Structure:

The GB hepatitis viruses has many serotype (GBV-A, GBV-B and GBV-C) (GC et al, 1995). Hepatitis G virus (HGV) or GB virus C (GBV-C) was first discovered and initially identified in 1995, then classified under the Flaviviridae family, and first detected and reported in 1996 in China. Hepatitis G virus is structurally and epidemiologically closest to hepatitis C virus (HCV) and may cause acute and chronic hepatitis (Taiwu Wang et al, 2019)

2.6.2 Epidemiology:

Overall, the mean prevalence of HGV RNA in blood donors is 4.8% worldwide and varies by ethnicity and location, for example, 1–2% in Saudis, 3.4% in Asians, 4.5% in Caucasians, and approximately 17.2% in South Africans and Egyptians (Taiwu Wang et al, 2019).

2.6.3 Transmission:

In addition, HGV could be efficiently transmitted by parenteral routes, such as sexual contact, intra-familiar transmission, intravenous drug use, and exposure to contaminated blood and blood components (Juecai Chen et al, 2018).

Chapter Three:

Subject & Method

3. Subjects and Methods:

3.1. Type of Study:

This study was designed as a retrospective observational study aimed at assessing the prevalence of immunization status against viral hepatitis among a group of physicians and dentists who had received the viral hepatitis vaccine. The data were obtained from archived medical and vaccination records of healthcare workers (Staff of the College of Dentistry ,Dental student (5th and 4th stages) ,Newly graduate dentist and academic staff of the College of Dental Technology).

3.2. Settings:

This study was conducted at the College of Dentistry, Al-Mustaqbal University, during the first semester of the academic year 2025–2026 and extended , over a period extending from January to March 2026.

The data were collected from student to healthcare staff working in the following dental clinics:

3.2.A. Staff of the College of Dentistry

3.2.B.Newly Graduated Dentists

3.2.C. Dental sstudens (5th Stage)

3.2.D. Dental students (4th Stage)

3.2.E Staff of the College of Dental Technology

3.3. Subjects:

This retrospective study included a total sample of (125) physicians and dentists who were working in the teaching dental clinics of the College of Dentistry at Al-Mustaqbal University during the second semester of the academic year 2025–2026.

All included subjects had received the viral hepatitis B (HBV) vaccination, and their medical records were reviewed to evaluate vaccination coverage and related variables.

3.4. Statistical Analysis:

Data were analyzed using the Statistical Package for Social Sciences (SPSS), version 26 (SPSS Inc., Chicago, Illinois, USA).

Descriptive statistics, including mean, standard error, and standard deviation, were calculated. Results were expressed as frequencies and percentages .

Inferential statistical analysis was performed using the Chi-square test, and a p-value ≤ 0.05 was considered statistically significant.

Chapter Four:

Result

4. Results

4.1 General demographic descriptive preview of the studied Hepatitis B vaccinated participants groups who have self-responses to questioner:

4.1.1 General distribution of total participants groups how received Hepatitis B vaccination according to their departments:

Regarding to the study which relied on self-reported data obtained through questionnaire, there were 125 responses (Table 4.1). The responses according to academic specialization, dental technician were 8 (18%) while 117 responses as were dental academic staffs and students (82%). There were statistically significant differences between vaccinated and un-vaccinated groups (X^2 =44.76, P<0.001).

Table 4.1: General distribution of total Hepatitis B vaccinated participants groups according to their departments.

Responses	No.	%	Chi-square (χ^2)	p-value
Dental department	**117**	**82**	**44.76**	**<0.001****
Technical department	**8**	**18**		
Total	**125**	**100**		

**** refer to significant difference at (p≤0.0005)**

4.1.2 General sex distribution:

The enrolled group of the researched participants has comprised 82 female (65.6%) and 43 male (34.4%), with female to male ratio was 1.9:1. There were statistically significant differences between male and female (X^2 =12.90, P<0.001). (Table 4.2).

Table 4.2: General distribution of studied participated group according to their sex.

Sex	No.	%	Chi-square (χ^2)	p-value
Male	43	33.6	**12.90**	**<0.001****
Female	82	65.6		
Total	125	100		

**** refer to significant difference at (p≤0.0005)**

4.1.3 Distribution of Hepatitis B vaccinated responders according to their age:

The age of subset of 125 responders to questioner has varied from 20-50 years old. . According to age stratifications, those patients in age group of 20-35 years constituting 91.3%, while those patients in age group of 36-45 years constituting 6.3% and lastly patients in age group of 46-50 years constituting 2.4%. There were statistically significant differences between different age groups (X^2 =184.05, P<0.001). (Table 4.3).

Table 4.3: General distribution of the Hepatitis B vaccinated self-responders according to their age strata.

Age stratum(years)	No.	%	Chi-square (χ^2)	p-value
20-35	114	91.3	**184.05**	**<0.001****
36-45	8	6.3		
46-50	3	2.4		
Total	125	100		

**** refer to significant difference at (p≤0.0005)**

4.1.4 Distribution of the Hepatitis B vaccinated responders according to their education levels:

There were 61responders in the group of fifth year dental students (48.8%) of them, newly graduated dentists shared 16 responses (12.8%), 19 responses from fourth year dental students (15.2%), 20 were as dental academic staff (16%), 9 were dental technician students (7.2%). Statistical analysis reveal highly significant difference (X^2 =67.76, P<0.001). (Figure 4.1).

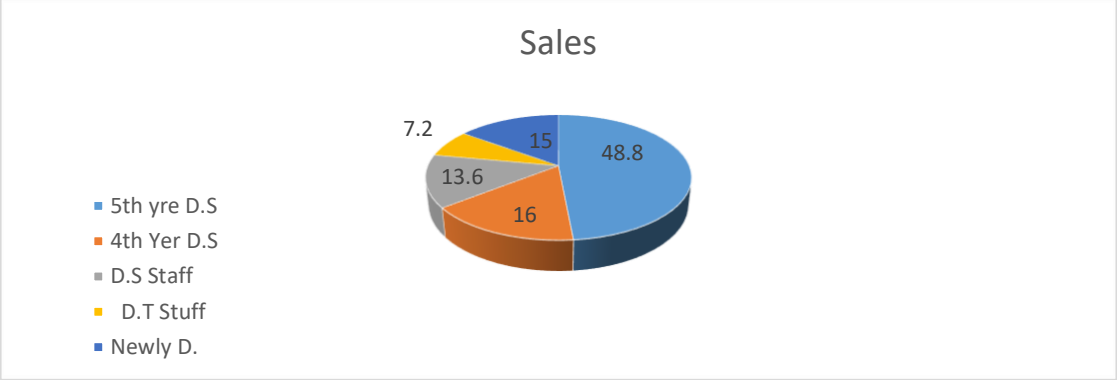

Figure 4.1: Distribution of data collected from responders according to education levels.

4.2 General distribution of the responders according to the state of HBV vaccination:

Data analysis that applied on 125 questioners responders have revealed that there were 99 (79.2%) responders had received the HBV vaccine, while 26(20.8%) were unvaccinated. Statistical analysis reveal highly significant difference (X^2 =44.76, P<0.001) (Table 4.4).

Table 4.4: Distribution of the responders according to HBV vaccination status.

Vaccine status	No.	%	Chi-square (χ^2)	p-value
HBV vaccinated	99	79.2	**44.76**	**<0.001****
HBV unvaccinated	26	20.8		
Total	125	100		

**** refer to significant difference at (p≤0.0005)**

4.2.1 Distribution of vaccinated females to their un-vaccinated counterpart ratio among total vaccinated responders:

The females represented 65.6% (as mentioned in table 4.2) of the total study population (N=125). Among them, 66(52.8%) were vaccinated, while 16(12.8%) were unvaccinated. Statistical analysis reveal highly significant difference among vaccinated and non-vaccinated female (X^2 =30.48, P<0.001) (table 4.5).

Table 4.5: The distribution of vaccinated and non-vaccinated ratios among female responders.

HBV vaccination status	No.	%	Chi-square (χ^2)	p-value
vaccinated females	66	52.8	**30.48**	**<0.001****
unvaccinated females	16	12.8		
Total	82	65.6		

**** refer to significant difference at (p≤0.0005)**

4.2.2 Distribution of vaccinated and un-vaccinated males among the total responders:

While total male responders were 43(33.6%) (Referred to Table 4.2), Vaccinated males represented 32(25%) of sample, whereas unvaccinated males comprised 9 (7.2%) (Table 4.6). There were statistically significant differences between vaccinated and un-vaccinated males (X^2 =12.90, P<0.001).

Table 4.6: The percentage of vaccinated to un-vaccinated males.

Vaccination status	No.	%	Chi-square (χ^2)	p-value
HBV vaccinated male	32	25	**12.90**	**<0.001****
HBV unvaccinated Male	9	7.2		
Total	41	32.2		

**** refer to significant difference at (p≤0.0005)**

4.2.3 Distribution of Hepatitis B vaccine doses among dental and technical receivers.

A chi-square test of independence was conducted to examine the distribution of vaccination doses among the study participants (Table 4.7). The results indicated a significant difference in the frequency of participants across the vaccination categories (chi-square is 30.58, $P < 0.001$). The majority of participants had received two doses 39 (31%), followed by one dose 29 (23%), and three doses 28 (22.4%), whereas a small proportion had received a booster 2 (1.6%).

Table 4.7: Distribution of number of HBV vaccine doses received by studied responders.

HBV vaccine Doses	No.	%	Chi-square (χ^2)	p-value
One dose	29	23.2	**30.58**	**<0.001****
Two doses	39	31.2		
Three doses	28	22.4		
Three doses with booster	2	1.6		
unvaccinated	27	21.6		
Total	125	100		

**** refer to significant difference at (p≤0.0005)**

Chapter Five:

Discussion

Discussions :

The five liver-specific viruses: Hepatitis A virus, hepatitis B virus, hepatitis C virus, hepatitis D virus, and hepatitis E virus, each have their own unique epidemiology, structural biology, transmission, endemic patterns, risk of liver complications, and response to antiviral therapies Viral hepatitis B represents a major danger to public health, and is a globally leading cause of death (Terrault NA et al. 2021).

There remain few options for treatment, in spite of the increasing prevalence of viral-hepatitis-caused liver disease. Furthermore, chronic viral hepatitis is a leading worldwide cause of both liver-related morbidity and mortality, even though effective treatments are available that could reduce or prevent most patients' complications (Razavi et al. 2020). In 2016, the World Health Organization released its plan to eliminate viral hepatitis as a public health threat by the year 2030 (World Health Organisation 2017)

Along with a discussion of current gaps and prospects for both regional and global eradication of viral hepatitis. Today, treatment is sufficiently able to prevent the disease from reaching advanced phases. However, the vaccination are extremely safe, and should ideally Present the need of such treatments and such complications of the dangerous view hepatitis both publics and medical dental staff in the field of risky contact with the infected patients limit the period of treatment necessary.

The transmission of blood-borne viruses in the dental office is a potential hazard to patients and dental staff, particularly to oral and maxillofacial surgeons. Hepatitis B virus has been a recognized hazard for several years, and in the past oral surgeons and other dental health care staff have been infected as a result of occupational exposure.

Hepatitis C virus in contrast does not appear to be a major occupational hazard to dental staff, nevertheless, infection with this virus can lead to significant morbidity and may have oral manifestations. Hepatitis D virus can be nosocomally transmitted, but vaccination against the hepatitis B virus minimizes this problem. Hepatitis E virus is not of clinical relevance to dentistry, although dental staff who are in areas of endemic infection can become infected as a result of enteric transmission. A number of other putative viral agents may also cause hepatitis, but additional data is awaited, and their significance to dental practice is unknown.(Sporter et al.1994)(Little JW, Falace DA2019)

In the current study in leaded a total of 125 participants from Al-Mustaqbal University were this respect to be assessed, including staff from the College of Dentistry and the College of Dental Technology, as well as 4th- and 5th-year students dentistry. The Participants' ages ranged from 20 to 50 years, with 33.6% males and 65.6% females. Among the total participants, 99 (79.2%) had received the viral hepatitis B vaccine, while 26 (20.8%) were unvaccinated.

The distribution of participants was as follows: 61 (48.8%) were 5th-Dentistry College staff, 20 (16%) were 4th-year ،year dentistry students dentistry students, 19 (15.2%) were dentistry graduates, and 9 (7.2%) were students from the College of Dental Technology Vaccination coverage was highest among 5th-year dentistry students.

Reflecting increased awareness and adherence to occupational health recommendations. Conversely, lower vaccination rates were observed among students of earlier stages and newly dentists , highlighting the need for targeted educational interventions.

These findings emphasize the importance of hepatitis B vaccination among healthcare workers and dental students, particularly in educational and clinical training settings, and underscore the role of preventive immunization programs in reducing occupational exposure to viral hepatitis B

These variations may reflect differences in infection control practices, occupational safety training, and adherence to preventive protocols. Nevertheless, the consistently high prevalence of needlestick and sharp injuries highlights their role as the primary sources of occupational risk and underscores the ongoing need for enhanced preventive strategies, strict compliance with infection control measures, and continuous professional education to reduce the transmission of blood-borne infections in dental settings. Percutaneous injuries reported by dental professionals in the USA from 1995 to 2001 occurred more frequently in dental assistants (75%), followed by dental hygienists (18%) and dentists (7%) (Shah et al.2006).

Exposure to Biological Fluids among Dental Practitioners:-

To evaluate the likelihood of transmission of a blood-borne virus, a good understanding is needed of the rate of needlestick, sharp and splash injuries occurring in dental practice, as well as the seroprevalence of blood-borne viruses in the respective country (MangkaraB et al.2020).

Occupational exposure to blood remains a significant concern among dental healthcare workers, reflecting the inherently high-risk nature of the dental clinical environment. Several studies have demonstrated considerable rates of accidental exposure incidents. For instance, at least one episode of occupational blood exposure was

reported by 26% of dentists and dental assistants in Lao within a six-month period and by 29.2% of dentists in Saudi Arabia over 12 months (Abalkhail et al. 2021). When evaluated across the entire professional career, similar rates (29.8%) were observed among dental assistants in Saudi Arabia.

Notably, even higher frequencies of sharp-related injuries have been documented in other regions. In Iran, more than half of dental personnel (54.5%) (Shaghaghian, et al.2014) .reported sharp injuries, while in Croatia, needlestick injuries were particularly prevalent, affecting 57.8% of dentists. Additional exposures included cuts (20.9%) and conjunctival contamination of the eye (13.4%) (Savic Pavicin,et al.2020)

Chapter six:

Conclusion & Recommendations

Conclusions:

1- Approximately three-quarters of participants were vaccinated, indicating good awareness of the importance of vaccination, although a considerable proportion remained unvaccinated.

2- Vaccination rates were higher among females than males, suggesting better adherence to preventive measures among women.

3- A substantial number of participants had received only one or two doses, which are insufficient for optimal protection and may be associated with inadequate Anti-HBs levels.

4- Although nearly one-third completed the three-dose schedule, booster uptake was low. Limited vaccine availability and incomplete compliance may explain these findings

Recommendations:

1. Educational programs (training workshops focusing on preventive measures against viral infections among target population and informative brochures highlighting the importance of vaccination, it is safety profile, and it is high efficacy in preventive viral infections). Such awareness campaigns play a crucial role in increasing vaccine acceptance, reducing hesitancy, and promoting public health.
2. Regular assessment of Anti-HBs antibody levels is recommended, particularly among dental students and healthcare workers.
3. Efforts should be made to improve the availability and accessibility of vaccines in healthcare centers to reduce incomplete vaccination rates.
4. Further large-scale studies (colleges of general medicine, nursing ,medical laboratory technologies , and community health department in Al-Mustaqpal University or even more Universities in Al-Hella city) are recommended to identify barriers to full vaccination and to assess long-term immune protection.

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Appendices

Appendices:

Appendic.1: Academic Staff Member at the College Of Dentistry.

Academic Staff Member At The College. Of Dentistry				
NO.	Age	Gender	Vaccinate	Dose
1.	28	Male	Yes	1
2.	24	Male	Yes	3+boost
3.	36	Female	Yes	3
4.	36	Male	Yes	3
5.	35	Female	Yes	3
6.	42	Female	Yes	3
7.	42	Male	Yes	3
8.	29	Male	Yes	3
9.	27	Female	Yes	2
10.	24	Male	Yes	3
11.	29	Male	Yes	3
12.	47	Male	Yes	3
13.	40	Female	Yes	3
14.	38	Male	Yes	3

15.	33	Male	Yes	1
16.	29	Male	Yes	3
17.	49	Male	Yes	3
18.	50	Male	Yes	2
19.	41	Male	Yes	3
20.	38	Male	Yes	3

Appendic.2: Newly Graduated Dentist.

Newly Graduated Dentist				
NO.	Age	Gender	Vaccinated	Does
1.	25	Male	Yes	3
2.	23	Female	Yes	2
3.	26	Male	Yes	3
4.	24	Female	Yes	1
5.	23	Female	Yes	1
6.	23	Female	Yes	1
7.	23	Female	Yes	1
8.	23	Female	Yes	1
9.	25	Male	Yes	No taking
10.	30	Male	Yes	No taking

11.	24	Male	Yes	3
12.	24	Female	Yes	2
13.	23	Female	Yes	1
14.	25	Female	Yes	3
15.	33	Female	Yes	2
16.	33	Male	Yes	3

Appendic.3: Dental student (5th stage).

Dental student (5th Stage)				
NO.	Age	Gender	Vaccine	Does
1.	23	Female	Yes	2
2.	30	Female	Yes	3
3.	22	Female	Yes	1
4.	22	Female	Yes	1
5.	22	Female	Yes	2
6.	22	Female	Yes	1
7.	22	Female	Yes	2
8.	22	Female	Yes	2
9.	22	Female	Yes	2

10.	22	Female	Yes	2
11.	22	Female	Yes	2
12.	22	Female	Yes	1
13.	22	Female	Yes	1
14.	22	Male	Yes	2
15.	22	Female	Yes	2
16.	22	Female	Yes	3
17.	22	Female	Yes	1
18.	34	Female	Yes	2
19.	22	Female	Yes	2
20.	22	Female	Yes	2
21.	33	Male	Yes	3
22.	22	Female	Yes	2
23.	22	Female	Yes	2
24.	22	Female	Yes	1
25.	22	Male	Yes	1
26.	21	Female	Yes	1
27.	22	Female	No	Not taking
28.	22	Female	Yes	2
29.	22	Female	Yes	1
30.	22	Female	Yes	2
31.	22	Female	Yes	2

32.	22	Female	Yes	2
33.	22	Male	Yes	2
34.	22	Female	Yes	1
35.	22	Female	Yes	2
36.	22	Female	Yes	2
37.	22	Male	Yes	1
38.	22	Female	Yes	1
39.	22	Female	Yes	2
40.	22	Female	Yes	2
41.	22	Female	Yes	2
42.	22	Female	Yes	2
43.	22	Female	Yes	2
44.	22	Female	Yes	1
45.	22	Female	Yes	2
46.	22	Female	Yes	2
47.	22	Male	Yes	2
48.	22	Male	Yes	3+booster
49.	22	Female	Yes	2
50.	22	Male	Yes	2
51.	22	Male	No	Not taking
52.	22	Male	Yes	3
53.	22	Female	Yes	1

54.	21	Female	Yes	3
55.	22	Female	No	Not taking
56.	23	Female	No	Not taking
57.	23	Female	Yes	3
58.	25	Male	No	Not taking
59.	23	Female	Yes	2

Appendic.4: Dental student (4th stage).

Dental students (4th Stage)				
NO.	Age	Gender	Vaccinated	Does
1.	20	Female	No	Not taking
2.	21	Female	Yes	1
3.	20	Female	No	Not taking
4.	21	Female	No	Not taking
5.	22	Female	Yes	2
6.	21	Female	No	Not taking
7.	22	Female	No	Not taking
8.	22	Male	No	Not taking

9.	22	Female	Yes	2
10.	22	Female	No	Not taking
11.	20	Female	No	Not taking
12.	21	Female	No	Not taking
13.	22	Female	No	Not taking
14.	20	Female	Yes	Not taking
15.	21	Male	No	Not taking
16.	21	Male	No	Not taking
17.	22	Male	Yes	2
18.	21	Female	Yes	1
19.	33	Male	Yes	3

Appendic.5: Staff of the College of Dental Technology.

Staff of the College of Dental Technology:				
NO.	Age	Gender	Vaccinated	Does
1.	20	Male	Yes	1
2.	22	Female	Yes	3

3.	**23**	**Male**	**Yes**	**1**
4.	**22**	**Female**	**No**	**No taking**
5.	**21**	**Male**	**No**	**No taking**
6.	**20**	**Female**	**No**	**No taking**
7.	**33**	**Male**	**No**	**No taking**
8.	**40**	**Female**	**No**	**No taking**
9.	**20**	**Female**	**No**	**No taking**


تم بحمد ربي
وتوفيقه