

## Hepatitis B Virus(HBV): Structure, Mode of Transmission, Pathogenesis and Clinical features, and the Role of Health Education in Prevention Strategies of HBV in Iraq

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### Abstract:

Hepatitis B virus (HBV) is one of the viruses that infect and cause a very dangerous disease, that may affecting many people around our world. It sometimes poses a serious health problem if left without treatment. As research shows that virus has its own way to infecting person mainly by blood of infected person and specific bodily fluids. It primarily infects the liver. The progression of the disease different from person to person as ranging from mild infections and then develops into severe and serious infections. On the other hand when the disease develops that can lead to cirrhosis and liver cancer. This virus known as its very complex structure and its replication mechanism that occur in host cells. Through this special mechanism of replication that help the virus to continues to stay and make great damage to the host cells. Although the present of effective vaccines and antiviral therapies, HBV continues to be major public health issue. This research presents aspects that contribute to increase our knowledge about the virus's structure also how it transmitted, that are essential for reduce its spread. It also explores the latest available preventive and treatment strategies, as well as the crucial role of health education. Cases of infection persist due to a low of health awareness, the prevalence of misconceptions, and inadequate preventive education about the virus. For this reason, this study highlights the importance of integrate health education and awareness programs into education through making seminars for students to increase their knowledge and reduce infection rates.

**Keywords:** Hepatitis B Virus, Transmission, Prevention, Health Education, Iraq.

### Introduction:

Hepatitis B Virus (HBV) has been known as a one of the disease that causing dangerous damage especially for liver because this virus infect this cells. Otherwise the infections not similar in all infected individuals and it may be begins with minor infection and some of them develop into major one. according to the information that found there is many people around the world they are living with chronic HBV infection(Centers for Disease

Control and Prevention, 2022). This chronic infections are leading to serious dangerous developments such as cirrhosis and liver cancer. Another point is for prevention this virus we need to learn more about it like its structural characteristics, how it is transmitted, and the ways for prevention from this virus. (World Health Organization, 2023). The most known way for treatment is vaccines against this virus that reduce the likelihood of future infection. In other way there are still many people infected with it, and sometimes can progress and lead to an increased risk of developing liver fibrosis, and into serious liver infections one of them cancer. Sometimes in this cases the infected person cannot survive and die(Lavanchy, 2004). The hepatitis B virus (HBV) is a small DNA virus which contains DNA with unusual features similar to retroviruses which it one of the virus belong to Hepadnaviridae family(Ganem & Schneider, 2001). The main way of Hepatitis B Virus transmitted is through contact to blood and body fluids of infected person. HBV can be transmitted in several ways one of them are occur during birth from mother to child (Centers for Disease Control and Prevention, 2022; Borgia , Carleo , Gaeta & Gentile, 2012). Other occur as a result of unprotected sexual behaviors, and also via unsafe intravenous injections, sharing contaminated needles.

#### **Epidemiology of HBV in Iraq:**

Hepatitis B virus is still considered a notable health challenge in Iraq, although the recent data that show decrease in the number of reported cases. According to research conducted in the years from 2012 to 2022 show a decline in incidence from 9.7 cases per 100,000 population in 2012 to 3.5 in 2022(Al-Sabbak et al., 2025). Iraq is regarded as an intermediate-endemic country, with infections between 1-2% in the general population(Ahmed et al., 2024). Recent regional studies shows the incidence of the disease variation from one governorate to another , in the Kurdistan region reported an HBsAg prevalence of 0.92% (Aziz et al., 2024). In Baghdad, the data from blood donation centers reported a relatively low level about 0.21% (Salman et ai., 2020). The research in Zakho city indicated that 1% of the tested population were HBV positive and high level of past exposure 8% (Hussein, Naqid & Abozait et al., 2025). And data from Al-Anbar governorate showed HBV positivity rate of 0.23% this also followed by decrease in infections across the country(Dawood , Al-Ani, Kuba, Nawaf & Thumil, 2025). Vaccination plays an important role in prevention and decreasing the infections of HBV, Prevention also followed by safe health behaviors and avoiding sharing of personal or medical things that may be contaminated.

Improving public knowledge about HBV this remain essential steps for reducing the spread of the virus in Iraq.

### Review

#### Classification of Hepatitis B Virus:

"Hepatitis B Virus(HBV) belongs to the Hepadnaviridae family and the Orthohepadnavirus genus "(Hunt, 2007; Beck & Nassal, 2007). The virus of this family it is a partially double-stranded DNA virus. As known about that virus is specifically infects human liver cells (hepatocytes). The effects of this virus are different from one to other patient as start by a simple illness with minor infection and progress into continual one. In many cases with continual sickness often leads to death(Seeger & Mason, 2000).

The one of classification of this virus the researchers classified it into ten genotypes (A–J). that means it classified according to the nucleotide sequence different of the genome(Hundie et al., 2017). If we need way to help us for discover the severity of the disease and response to treatment this different in genome genotypes will play an important role for that(Kramvis & Kew, 2005; Magnus & Norder, 1995). Studying and know of HBV genotypes is very important in vaccine development. also for learning another things that may help us in treatment and prevention of virus (Kramvis & Kew, 2005; Lin & Kao, 2017).

#### The Structure of HBV:

To explain the structure of this virus first we should know the virus found in form called Dane particle (virion)( Gerlich,2013). This virus consists of an outer lipid envelope, that envelope present by form that surrounding the virus. The very important thing we should know is the virus is gained that envelope from the host cell membrane. Another structure found in HBV is "containing hepatitis B surface antigens (HBsAg) in three forms: small (S), medium (M), and large (L)"( Lee & Ahn, 2011). The structure of envelope helping and plays a very substantial role in viral entry into the host cells(Nassal, 2016). The nucleocapsid core consists of protein and found in icosahedral forms. This core contains the viral DNA and also enzymes one of its called DNA polymerase, this enzyme has reverse transcriptase activity(Lin & Kao, 2017). The virus contain proteins which are play an important role in virus binding and enter into the host cells and this proteins are present in the outer envelope. The viral enzyme which called polymerase, that have ability to reverse transcription , allowing the virus to replicate through an RNA intermediate(Milich & Liang, 2003). And also this virus contain another protein which produced by virus and secreted into the blood during viral replication which known as a marker of viral replication(Summers & Mason,

1984). This protein, called HBeAg is an abbreviation for (hepatitis B envelope antigen). That protein not found on the surface of the virus but can be found in the bloodstream. The present of this protein in serum means high viral replication and infectivity. The structure of HBV as shown in figure 1 below.

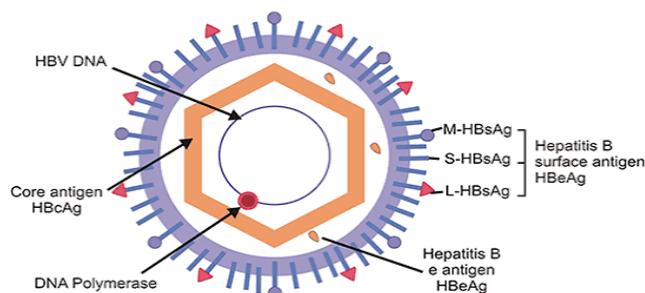
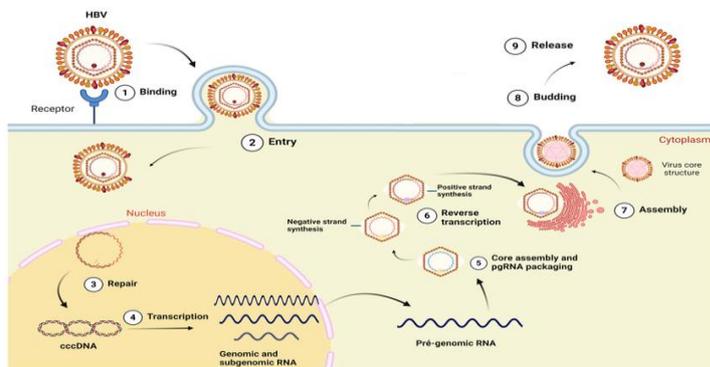


Figure 1. Structure of HBV (Gerlich,2013)

### Viral Replication:

The genomes of Human hepatitis B virus (HBV) is contain of partially single-stranded circular DNA molecules(Gerlich & Robinson, 1980). The mode of HBV replication, as we all knowing mainly depends on reverse transcription of an RNA(Summers & Mason, 1982). To describe the life cycle of HBV we should know it done by many steps that begins with the first step and it is attachment of the virus to the host cell. The virus enter the host cells after the attaching that occur by the envelope protein of the virus attaches to the receptor that found on the surface of the hepatocyte(liver cell) (Yan et al., 2012). Once the virus enters inside the host cell, the viral DNA moves to the nucleus and is converted into a covalently closed circular ccc DNA form(Nassal, 2008). Then this will being the template for virus RNAs transcription. The enzyme that help in replication is have reverse transcription ability and called DNA polymerases enzymes. After RNA synthesis it transported to the cytoplasm of host cell(Beck & Nassal, 2007) and complete its life cycle. The final steps are begins from all proteins synthesis and other viral structures. finally gathering and make new viruses that are leaving the cells as shown in Figure 2 below(Summers & Mason, 1982).



**Figure.2 Replication cycle of HBV (Summers & Mason, 1982)**

**Mode of Transmission:**

There are many ways for HBV transmission and the primary way is through the exposure to blood and body fluids of infected person. The transfer of hepatitis B virus occurs most often through straight transfer from mother to child during birth and this passage from the infected mother who she carries the virus . very high percentage of newborns baby are born carrying this virus acquired from their mothers who did not receive an HBV vaccination. That lead the baby to become HBsAg carriers within 6 months(Stevens, Neurath, Beasley & Szmuness, 1979; Xu, Liu, Francis, et al., 1985). And this way of transfer which cause infection during childbirth, passing on during delivery is one of the main route of HBV infection especially if the mother did not take the vaccine(Hamdani-Belghiti & Bouazzaou, 2000; Casalini, Signorini, Beltrame, et al., 2001). HBV can also be transfer between the partner during sexual intercourse that occur when one of them are infected and carry this virus so that can be transmitted from blood or other bodily fluids that contains the virus, that occur especially in states of unprotected sex. It is also spread through the sharing of contaminated objects of infected person, likes needles or sharp objects. This includes needles used at tattooing and body piercing saloons). And there is another ways of spread between the people which live in same house like family by using the same objects with the infected person like toothbrushes. We should take care because hepatitis B virus can also be spread through sharing earrings and other body piercing accessories(Centers for Disease Control and Prevention, 2022).

**Pathogenesis and Clinical features:**

**Pathogenesis:** The HBV is very effective and specific virus that infects liver cells specifically and after the virus enters the body by any way of transmission. By contact with infected blood or contaminated body fluids that carrying the virus. Occur after the virus reaches the host cells (liver cells). And the virus enter the cell by attaché to the receptors that found on the

surface of host cells . the pathogenesis not occur immediately after enter the cell the viral DNA is go to the nucleus. The DNA does not remain in its original form but it need to change into covalently closed circular DNA (cccDNA). This serves as a template for the transcription of viral RNA and the synthesis of viral proteins and particles(Seeger & Mason, 2000; Revill, Chisari, Block, et al., 2019). The injury of liver not caused by virus itself which it not directly cytopathic, instead that the infection is mainly caused by the host immune response. The immune response of the body which start to attack the infected cells which is liver cells by Cytotoxic T lymphocytes this immune cells recognize and destroy the infected liver cells, laeding to hepatocellular injury and inflammation(Guidotti, Chisari, 2006). The severity of the disease is determined by the strength of immune system if it strong immune response occur that leads to acute, self-limited infection. And if the immune system is weak the response to disease is weak ,leading to continual infection(McMahon, 2010). As the infections developed and result persistent liver inflammation, which may lead to fibrosis and liver cancer due to continuous of liver cells destruction and regeneration (Ringelhan, O'Connor, Protzer & Heikenwalder, 2015).

**Clinical Features:** The incubation period of HBV infection ranges from 1-6 months (Centers for Disease Control and Prevention, 2022).

**1. Acute Hepatitis B:** the symptoms of the disease range from asymptomatic to other symptoms. The common symptoms are tiredness associated with Loss of appet, Nausea and vomiting. Also noticed yellowing of skin caused by excessive bilirubin(Kumar, Abbas & Aster, 2021). In mostly the infected person is recover especially the adults from acute infection, in rare cases the disease may develop into sudden liver failure, which it could be fatal (Liaw & Chu, 2009).

**2. Chronic Hepatitis B:** this occur when infected person are gain infection during birth or during early childhood. In many times continue for years and are asymptomatic. But in advanced stages of liver injury are lead to serious sickness like liver failure and cancer(Schweitzer, Horn, Mikolajczyk, Krause & Ott, 2015). That develop in disease effects on the liver function lead it to declines. "complications such as ascites,, bleeding, and hepatic encephalopathy may occur " (Terrault, Lok, McMahon, et al., 2018).

**Prevention, and Treatment Strategies:**

**Prevention:** The main way for Prevention of hepatitis B virus (HBV) infection is achieved through vaccination. Although vaccination is very important for prevention , it is still not taken seriously by people. Also not only that it should associated with health awareness and do not share objects

with others. HBV vaccine It contains recombinant hepatitis B surface antigen (HBsAg). The vaccines are recommend for all newborns baby, consisting of three doses first dose within 24hr of birth, followed the other doses later doses(Centers for Disease Control and Prevention, 2022). This vaccine are long-term immunity and for people they have strong immune system they do not need additional dose(Schillie, Vellozzi, Reingold, et al., 2018). Also Use of sterile needles and syringes, and other objects that use in blood transfusion(Alter, 2003). Healthcare workers who they are in attach with the infected people they have to wear gloves and safely using of sharps and needle when they draw blood from the patient(World Health Organization, 2023). The laboratory staff must be especially careful when they drawing blood from a patient. Safe Sexual Behavior because the sexual contact is one of the way in which HBV can be transmitted through. Prevention by condom use, especially with new or multiple partners (Terrault, Lok, McMahon, et al., 2018).

**The treatment strategies** by using antiviral drugs, which are effective against viral replication and reduce the risk of liver disease (Liaw & Chu, 2009). Changing Lifestyle through avoiding alcohol, patients may require liver transplantation or targeted therapies(Terrault, Bzowej, Chang, et al., 2016; World Health Organization, 2015). From my as someone who once work in the medical field, I advice workers to always be careful when dealing with patient sample, as this is one of prevention methods.

### **The Role of Health Education in HBV Prevention in Iraq**

Hepatitis is a dangerous virus, so it must be controlled and prevented. One of the best ways to prevent it is to educate the community and increase cultural and health awareness among its members. Raising health awareness about this disease greatly contributes to understanding its severity and modes of transmission. This helps reduce infection by avoiding what causes it to spread between people. The first step we can take to increase awareness of preventing this virus is through education, by providing a simplified explanation of the disease, its transmission methods, and how to prevent it. This can be done through seminars or lectures primarily aimed at students to increase their health awareness and encourage them to get vaccinated to avoid infection. It also corrects misconceptions, such as the fear of approaching infected people. This is done by explaining that the disease is not transmitted through proximity to the patient or through respiratory droplets, but rather through direct contact with the blood or bodily fluids of an infected person. Its important to help reduce the stigma associated with the disease. Correcting the wrong idea in young people who believe that they can

do anything with the term of personal freedom. As a one who once worked in a medical lab the most samples that come are for young people their ages between 20-38 years. most of young people who they are infected with this virus are doing things including tattoos and other actions, which they consider it progress and freedom. This wrong thought which enter to our country from foreign countries and we should take it into consideration. By explaining and correcting this wrong ideas and that is one way of prevention the infections with this virus.

### Conclusion

The Hepatitis B Virus (HBV) is a virus that infects the liver cells specifically and cause infections start from minor to sever conditions which leads to very risk diseases like cirrhosis and liver cancer and maybe leas to death in continual sickness. The virus does not cause the disease by itself instead that the immune cells are which response to the infected liver cells it cause to attack its own cells and destroyed it. This virus has many ways of transmission and transfer through direct contact with contaminated blood and body fluid of the infected person. The main way of prevent HBV is through vaccination, which is very necessary for prevention. Increasing health awareness and education about this disease, by holding seminars and lectures at universities for students about this virus and how to prevent it. And to dispel misconceptions about this virus and reduce feelings of fear and shame associated with the disease. correcting the wrong ideas that young people believing it like freedom and evolution they take it from other countries. The most wrong idea and it has very serious role in the virus transmission is tattoo and other wrong thing, that we should be careful from it.

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فيروس التهاب الكبد B التركيب، طرق الانتقال، المرضية والاعراض السريرية ودور  
التثقيف الصحي في استراتيجيات الوقاية من فيروس التهاب الكبد B في العراق

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مستخلص البحث:

يُعد فيروس التهاب الكبد نوع B هو احد الفيروسات التي تُصيب الانسان و قد تسبب امراضاً خطيرة تؤثر على العديد من الاشخاص حول العالم. يشكل هذا الفيروس في بعض الاحيان مشكلة صحية خطيرة اذا تُرك دون علاج. تُظهر الابحاث ان للفيروس طرقه الخاصة للإصابة بالإنسان، و يتم ذلك بشكل رئيسي عن طريق دم الشخص المصاب و بعض السوائل الجسدية المحددة. يستهدف الفيروس الكبد بشكل أساسي و يختلف تطور المرض من شخص لآخر، حيث قد يبدأ بعدوى بسيطة ثم يتطور الى حالات شديدة و خطيرة. وقد يؤدي تقدم المرض احياناً الى تليف الكبد و سرطان الكبد. يتميز الفيروس ببنية معقدة للغاية و آلية تكاثر خاصة داخل الخلايا المضيئة، مما يسمح له بالبقاء و احداث اضرار كبيرة. على الرغم من وجود لقاحات و علاجات مضادة فعالة، لا يزال فيروس التهاب الكبد نوع B يمثل قضية صحية عامة كبيرة. يقدم هذا البحث معلومات حول بنية الفيروس و طرق انتقاله، و هي عناصر اساسية للحد من انتشاره، كما يستعرض احداث استراتيجيات الوقاية و العلاج، و الدور الحيوي للتثقيف الصحي. تستمر حالات العدوى بسبب ضعف الوعي الصحي، و انتشار المفاهيم الخاطئة، و عدم كفاية التعليم الوقائي. لذلك يسلط هذا البحث الضوء على اهمية دمج برامج التوعية و التثقيف الصحي في التعليم، مثل اقامة ندوات للطلاب لزيادة معرفتهم و تقليل معدلات الإصابة.

الكلمات المفتاحية: فيروس التهاب الكبد نوع B، الانتقال، الوقاية، الوعي الصحي، العراق.