Epidemiology Of Hepatitis B Virus Infection (HBV) among Students Of Health Sciences Faculties in University of Gezira, Sudan

By

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Date of Examination 16/9/2012.
Dedication

To My Husband

To

My Daughter

To

My family' members

To

The spirits of my mother, Karam alla and Khalid
ACKNOWLEDGEMENT

My first praise to Alla who gave me health, power and patience to complete and conduct this research.

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Epidemiology Of Hepatitis B Virus Infection (HBV)
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By
Ehsan Hassab El rasoul Hassan Mohammed
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Faculty of Health and Environmental Sciences
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ABSTRACT
Hepatitis B virus infection is a major worldwide public health problem. Sudan was classified with high prevalence of HBsAg with an endemicity of (8%) . Students of health sciences are at high risk of acquiring (HBV) infection. The aim of this study is to study the epidemiology of Hepatitis B Virus infection among students of health sciences faculties in the University of Gezira during the period of Dec.2009 to May 2010 . 649 students were selected by stratified random sampling . Two laboratory diagnostic tests were used for screening of HBsAg in blood , ICT and ELISA . 649 blood samples were tested by ICT. Only (7 out of 649) (1.1%) were positive to HBsAg . ELISA had been done as a confirmative test for the (7) positive samples by ICT. All of them were found positive for HBsAg . The students with positive HBsAg were from faculty of laboratory sciences (2 out of 47) (4.8%) , followed by medicine (4 out of 284) (1.4 %) and applied sciences (1 out of 120) (0.83%), males were more infected than females with male to female ratio 6:1 , (71.4%) of students who were positive to HBsAg were from Gizera state , (57.1%) of them had a past history of jaundice, (1.1%) of the students had illegal sexual practices and only (17%) of them were vaccinated. The study recommended that, screening and vaccination of health sciences students against HBV infection should be started at the first registration in the university . This should be followed by health education and improvement of control measures in hospitals.
وبائية التهاب الكبد الفيروسي (ب) وسط طلاب كليات العلوم الصحية
بجامعة الجزيرة، السودان

احسن حسب الرسول حسن محمد

لئن درجة دكتوراه الفلسفة في الوبائيات (سبتمبر 2012)
كلية العلوم الصحية والبيئية
جامعة الجزيرة

ملخص الدراسة

يمثل التهاب الكبد الفيروسي من النوع (ب) مشكلة صحية عالمية. يصنف السودان من أكثر الدول المستوطنة بالتهاب الكبد الفيروسي (ب) بنسبة (8%). طلاب العلوم الصحية أكثر عرضة للإصابة بالمرض. اجريت هذه الدراسة بهدف دراسة وبائية التهاب الكبد الفيروسي (ب) وسط طلاب كليات العلوم الصحية بجامعة الجزيرة، في الفترة من ديسمبر 2009- مايو 2010. 649 طالب وطالبة تم اختبارهم عن طريق العينة الطبقية العشوائية، وتم إجراء اختبارين معمليين لفحص المستضد السطحي لفيروس التهاب الكبد من النوع (ب). في الدم، هما الاستشراب المناعي والألبيزا. 649 عينة من الدم تم فحصها بواسطة اختبار الاستشراب المناعي. 74/69 من العينات اعطت نتائج موجبة للمستضد السطحي لفيروس التهاب الكبد (ب) بنسبة (1.1%) إجراي اختبار الإلبيزا كاختبار تأكدي للعديد من العينات، فاعطت ايضاً نتائج موجبة للمستضد السطحي لفيروس التهاب الكبد (ب). المصابة من كلية المختبرات كانو 2 من 47 من كلية الطب 4 من 284 من كلية العلوم التطبيقية 1 من 120 من كلية العلوم التطبيقية 1 من 120 (0.83%) 1.4% من كلية الطب 4 من 284 من كلية الطب 4 من 284 (1.4%) . النتائج أكثر أصابه بالمرض من الانتهاط بمعدل 1:6. (71.4%) من الطلاب المصابين من ولاية الجزيرة، (57.1%) من الطلاب المصابين بالمرض لديهم أصابه سابقه بالبركان. الممارسات جنسيه غير الشرعية بين الطلاب كانت (1.1%) و (17%) فقط من الطلاب مطعنين. اوصت الدراسة بضرورة فحص الطلاب وتعينهم ضد التهاب الكبد (ب) عند أول تسجيل لهم بالجامعة وضرورة التثقيف الصحي للطلاب عن المرض وتطوير الاجراءات اللازمه للسيطره على المرض داخل المستشفيات.
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LIST OF ABBREVIATIONS

AA SLD : American Association for Study of Liver Diseases.
ACHA : American College Health Association.
AMLF : American Liver Foundation.
HBV : Hepatitis B Virus.
HCV : Hepatitis C Virus.
HDV : Hepatitis D Virus.
HCC : Hepato Cellular Carcinoma.
ICT : Immune Chromographic Test.
ELISA : Enzyme Linked Immuno Sorbent Assay.
WHO : World Health Organization.
CDC : Centre for Diseases Control and prevention.
RNA : Ribo Nucleic Acid.
DNA : Deoxyribo Nucleic Acid.
ALT : Alanine Transferase.
AST : Aspartate Transferase.
ALP : Alkaline Phosphate.
PT : Prothrombin Time.
MFMER : Mayo Foundation for Medical Education and Research.
SAVIC : South Africa Vaccination and Immunization Centre.

U OF G : University of Gezira.

HBsAg : Hepatitis B surface Antigen.

HBCAg : Hepatitis B core Antigen.

HB eAg : Hepatitis B pre core Antigen.

anti HBs : Antibody to hepatitis B surface antigen.

anti HBC : Antibody to hepatitis B core antigen.

anti HBe : Antibody to hepatitis B pre core antigen.

IgG : Immunoglobulin G.

IgM : Immunoglobulin M.

HBIG : Hepatitis B Immunoglobulin.

SPSS : Statistical Package for Social Sciences
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CHAPTER ONE

Introduction

1.1. Preface

The liver is a vital organ located in the upper right-hand side of the abdomen. It performs many functions in the body, including processing the body's nutrients, manufacturing bile to help digestion of fats, synthesizing many important proteins, regulating blood clotting, and breaking down potentially toxic substances into harmless ones that the body can use or excretes, (AASLD, 2005).

Hepatitis implies injury to the liver characterized by the presence of inflammatory cells in the tissue of the organ. The name is from ancient Greek hepar the root being hepat meaning liver and itis, meaning "inflammation" The condition can be self-limiting, healing on its own, or can progress to scarring of the liver. The liver becomes tender and enlarged and unable to function normally. (Cortese, 2009).

Hepatitis can occur from many different causes such as viruses, chemicals, drugs, alcohol, inherited diseases or patient's own immune system. More rarely bacterial diseases, fungal infections and parasitic infections (WHO, 2004).

The most common causes of the hepatitis is an infection with the virus. The viruses primary associated with hepatitis are named in the
order of their discovery A, B, C, D and E. These viruses are not related to each other and differ in their structure, the way they spread among individuals, the severity of symptoms they can cause, the way they are treated and the outcome of infection (Nettleman and Mortuda, 2011). All hepatitis viruses can cause an acute (short term) form of liver disease. Some specific hepatitis viruses (B, C and D) can cause long term liver disease (hepatitis) (Simon and Zieve, 2008).

Viral hepatitis was first described in the fifth century BC. When Hippocrates described epidemic jaundice, he was undoubtedly referring to person infected with acute hepatitis B virus (HBV) as well as other agents capable of affecting the liver. Epidemics of jaundice have been described throughout the history and were particularly common during various wars in the 19th and 20th centuries. While many of these outbreaks were due to hepatitis A, it is likely that epidemic transmission of hepatitis B also occur in setting where the use of blood-containing products was common (Mahoney, 1999).

The recognition of a form of hepatitis that was transmitted by direct inoculation of blood or blood products was first documented by Lurman in Bremen, Germany, in 1883, during a smallpox immunization campaign. Thousands of persons received vaccine that had been prepared from human lymph. Of 1289 shipyard workers who received this vaccine,
191 (15%) developed jaundice several weeks to 8 months later, jaundice did not occur among unvaccinated workers. (Shepard, et al, 2006).

In the first part of the 20th century, outbreaks of "long inoculation" hepatitis were described in a variety of risk groups including persons who attended clinics for venereal diseases, diabetes and patients who received blood transfusions. (Neefe et al, 1946).

The discovery of etiologic agent of hepatitis B and the development of safe and effective vaccines constitute one of the remarkable scientific achievements of the 20th century. (Mahony, 1999). Hepatitis B infection is a major public health problem. It is a potentially life-threatening liver infection, most serious type of viral hepatitis, that puts people at high risk of death from cirrhoses of liver and liver cancer, it may be the cause of 80% of all cases of hepato-cellular carcinoma (HCC) worldwide. It is transmitted through contact with infected blood, body fluids. Three modes of transmission have been recognized; perinatal, sexual, parenteral/precutaneous transmission. (WHO, 2010).

Frequent and routine exposure to blood or serum is common denominator of health care occupational exposure. Surgeon, dentists, oral surgeons, pathologists, operating room and emergency room staff and clinical laboratory workers at highest risk of developing the disease.
Also infants born to infected mothers, sexual household contact to infected person, patients and employees in heamodialysis centres, injection drug users, sharing unsterile needles, people sharing unsterile medical or dental equipments, people living in regions or travelling to regions with endemic hepatitis, sexually active hetro-sexual and men who have sex with men are at high risk of infection (WHO, 2010).

Hepatitis B virus (HBV) infection is well recognized occupational risk to health care workers. The risk of infection has been demonstrated to be primarily related to the degree of contact with blood in the work place. Serological studies conducted in low HBV prevalence countries during 1970s demonstrated that health care workers had a prevalence of HBV infection up to 10 times higher compared to general population, routine pre exposure vaccination of health care workers against hepatitis B and use of the universal precautions to prevent exposure to blood and other potentially body fluids have been recommended in many countries since the vaccine become available in early 1980s. In United States regulations issued by the Occupational Health and Safety Administration have increased compliance with these recommendations. Because of the high risk of HBV infection among health care workers (Alter, 2005).

Also health sciences students may be exposed to blood, body fluids or tissues from patients with HBV infection, in addition during college,
students may travel aboard to areas where the disease is common, and during sports in which players may be exposed to each other's blood or saliva (ACHA, 2001).

Determining the prevalence of HBV infection in health students is important in planning for any intervention to control this infection among them. Furthermore, the information obtained may be used in wider sense to create awareness among all categories of health care workers about the magnitude of the risk of contracting or transmitting HBV in work place (Pido and Kagimu, 2005).

1.2. Size of the problem: (Globally)

Hepatitis B is a major worldwide health problem that cause a considerable morbidity and mortality in human population. It has been estimated that more than two billion people (one third of world’s population) have been infected with hepatitis B virus infection globally. This figure includes 350 million chronically infected carriers of the hepatitis B virus. Approximately 15-40% of infected patients will develop cirrhosis, liver failure or hepato cellular carcinoma (HCC). HBV account for more than one million death every year (WHO, 2004). It is 10th leading cause of death worldwide. HCC incidence has increased worldwide and the disease is now 5th most frequent cancer, killing 300,000 – 500,000 people each year (Lavanchy, 2004).
The world can be divided into three areas where the prevalence of HBV is high (> 8%), intermediate (2-7%) and low (< 2%). Approximately (45%) of world population live in areas where chronic HBV infection is highly endemic, (43%) live in areas of intermediate endemicity and (12%) live in areas of low endemicity (WHO, 2010).

The prevalence of HBV varies greatly throughout the world. It is specially high in Asia, Subsaharan Africa, South Pacific, as well as in specific population in South America and Middle East (O'shea, 2011).

It has been estimated that 78% of all cases in Asia, 16% of all cases in Africa, 3% of all cases in South America and 3% of all cases in Europe, North America and Occrania (Blood Safety Surveillance and Health care Acquired infections Division, Health Canada, 2002).

The prevalence of chronic HBV infection in Asia-Pacific region is among the highest in the world is (>10%), the prevalence is low (<1%) in Australia and Newzealand, 1-1.5 % in Japan, Singapore India and Thiallland, 6 – 8 % in Bangladesh, Indonesia, and Northern China and highest (>10%) in Taiwan, Southern China, Korea Philippines and Melansia (Chen, et al., 2000). Approximately 75% of chronic carriers live in Asia and Western Pacific (Gust, 1996).
In United States of America, the prevalence of HBV varies, based on the population make up, including the extent of immigrant population from endemic areas, and on risk factors and behaviors such as the prevalence of intravenous drug use and homosexual practices (WHO, 2004).

In the United States, area of relatively low endemicity, there are between 140,000 - 320,000 infected every year of which 70,000 - 160,000 are symptomatic infections, of these symptomatic infections, there are 8,400 – 19,000 hospitalization/year and only 140 -320 (0.2%) deaths, of all these infections yearly, about 8,000 - 32,000 (6 -10%) of cases develop into chronic viral carriers and there are 5,000 – 6,000 deaths/year as a result of complications that chronic HBV infection causes Overall, there are an estimated 1 -1.25 million people infected in United States (CDC, 1999).

In Middle East, the majority of countries in regions have an intermediate or high endemicity of chronic HBV carriers, the prevalence of HBsAg in middle East range from 3-11% in Egypt, 4 – 5% in Iraq, 2.6 -10 % in Jordan, 2 – 6 % in Libyan Arab Jamahiriya, 2.3 – 10 % in Oman, 5 – 6 % in Palestine, 7.3 – 17 % in Saudia Arabia, 6.5 % in Tunisia, 2 – 5% in UAE and 12.7 – 18.5% in Yemen (Qirbi and Hall, 2011).
1.3. Prevalence of HBV infection in Africa

Hepatitis B is an ongoing medical threat to the whole of Africa North, East, South Africa show greater rate of HBV infection (Reynard, 2002). Of approximately 350 million in the world chronically infected with HBV, 65 million reside in Africa, thus, Africa with 12% of world’s population, carriers approximately 18% of the global burden of HBV infection, with hepato cellular carcinoma and cirrhosis accounting for 2% of the continents annual death (Kramvis and Kew, 2007).

In Subsaharan African countries infants and young children are most at risk of HBV infection. In South Africa, hundreds of thousands of people seek medical care or hospitalized or die from HBV infection. Every one at risk although the disease affects the black population more than other groups. It is estimated that over 50% of south Africans have been infected by the HBV and at least 3 million people are chronic hepatitis B carriers (CDC, 2009).

Also in Subsaharan the carrier rate range from 9 – 22 % among blood donors (Ogbru and Uneke, 2009).
Ebdo el karim and Thejpal, 1989, reported that in Africa the HBsAg prevalence rate vary from 2.1% in Kenya to 12% in Somalia, 13.6% in Namibia and 4.6% in Kangwae.

1.4. Prevalence of hepatitis B virus infection in Sudan

Sudan is classified among the countries with high HBV endemicity, screening of blood and blood products to HBV was only introduced to blood banks in 2005 before which, screening was only performed in a very few centers in the capital Khartoum. Vaccination to HBV was introduced as a part of the extended program of immunization in 2005 (Mudawi et al., 2007).

Also Mudawi, et al., (2008) reported that prevalence of HBsAg in Sudan in range of 6.8% in central Sudan to 26% in Southern Sudan.

Qirbi and Hall, (2011) reported that the prevalence of HBV infection in Sudan was 16 – 20%.

Several studies were conducted to study the prevalence of HBV infection in different parts of the Sudan. Alarabi et al., (1986) reported on the aetiology of acute viral hepatitis in Omdurman. They found that the prevalence of HBV infection was 12.6% on the study population, Hyam et al., (1989) conducted study on the prevalence and risk factors of HBV infection in Gezira rural areas. HBs Ag was found to be in 18.7% of study population, also Hyam et al.,
(1991) reported in different viruses in Khartoum, HBV infection was found to be (10%)

Michael et al., (1994) conducted study in Juba, the capital of South Sudan. They compared the epidemiology of HBV with HCV in population of 666 subject HBV was found in 26% of subjects in contrast only 3% were positive to HCV.

Makram conducted study on the prevalence of HBV and HCV among patients with acute viral hepatitis in Khartoum (unpublished study) found 28% seropositively to HBV and 13% for HCV and 5% had mixed infection among 45 patients studied (Morgan, 1998).

In Gezira state the prevalence of HBV infection was (12%) (Wad Medani Central Blood Bank, 2007). The prevalence of HBV infection is high in Gezira state and it is hoped that introduction of blood screening and vaccination against HBV would decrease the carriers pool in the next few years. More studies should be made in order to measure such a reduction and monitor the effectiveness of the screening and vaccination program (Mudawi et al., 2007). So the study of epidemiological aspects of HBV infection will be of great benefit because of its tendency to become chronic and fatal result.
1.5. Rationale

- Hepatitis B is a serious infection which may lead to chronic liver diseases; cirrhosis, failure, cancer and even death.
- Patients and carriers may look well (have no symptoms) and don’t realize they are infected, they transmit the infection to households and wherever they go without recognizing that.
- In 5 – 10% of hepatitis B cases, the disease become chronic making liver vulnerable to cancer.
- About 20% of adults who become chronically infected during childhood later die from liver cancer or cirrhosis caused by chronic infection.
- Hepatitis B virus is 50 – 100 time more infectious than (HIV).
- Hepatitis B infection will become a great obstacle in the way of people who are traveling aboard.
- Hepatitis B is an important occupational hazards for health workers.
- Students of health sciences are at high risk of developing the disease.
1.6. Objectives

1.6.1. General objective:

- To study epidemiology of hepatitis B among students of Health Sciences in the University of Gezira.

1.6.2. Specific Objectives

- To determine the prevalence of hepatitis B virus infection among students.
- To assess the students' knowledge about hepatitis B virus infection causative agent, routes of transmission and prevention.
- To identify the possible risk factors associated with the infection.
- To identify the possible routes of transmission.
- To determine the percentage of vaccinated students.
- To make possible recommendations.
1.7. Hypothesis

1. High prevalence of hepatitis B among students of health sciences.
2. Low level of immunization
3. The majority of hepatitis B cases at subclinical stage (carrier) who shed the infection for a long period in the community.
4. Lack of awareness towards the disease.
5. Association of past history of schistosomiasis of HBV infection may be a co-factor.
CHAPTER TWO

Literature Review

Hepatitis B is an infectious illness caused by hepatitis B virus (HBV), which infects the liver of hominoidea including humans and causes an inflammation called hepatitis originally known as "serum Hepatitis" (Barker et al., 1996).

Hepatitis B Virus infection is a common serious liver disease, resulting from infection with HBV. It is a contagious disease. It can range in severity from mild illness lasting a few weeks to serious life long illness (CDC, 2009).

Hepatitis B virus infection is a major public health problem causing considerable morbidity and mortality from both acute and chronic sequelae including chronic hepatitis, cirrhosis and hepatocellular carcinoma (HCC). (Mudawi, 2007).

2.1. Causative agent

Hepatitis B is a disease caused by Hepatitis B virus (HBV). The virus was not discovered until 1965 when Baruch Blumberg working at National Institute of Health (NIH), discovered the Australania antigen (later known to be hepatitis B surface antigen) (HBsAg) in blood of Australi aboriginal people. (Maccallum, 1974). HBV is a member of Hepadna virus family (Zuckerman, 1996). It is an extremely resistant
strain capable of withstanding extreme temperatures and humidity and surviving when stored for 15 years at -20°C, for 24 months at -80°C for 6 months at room temperature and for 7 days at 44°C (Ogbru and Ueneke, 2009).

2.1.1. Structure

The virus called Dane Particle (virion), is 42 nm spherical double – shelled particle consisting of small spheres and rods, with an average width of 22 nm. It consists of an outer lipid envelope and an icosahedral nucleocapsid core composed of protein. The nucleocapsid encloses the viral DNA polymerase that has reverse transcriptase activity (Locarnini, 2004).

The outer envelope contains embedded proteins which are involved in viral binding of, and entry into susceptible cells. The virus has pleomorphic forms, including filamentous and spherical bodies lacking a core. These particles are not infectious and are composed of lipid and protein that forms part of the virion, called surface antigen (HBS Ag) and is produced in excess during life cycle of the virus (Howard, 1986).

2.1.2. Genome

The viral genome of a partially double stranded circular DNA, but is unusual because the DNA is not fully double-stranded. One end of the full length strand is linked to the viral DNA polymerase. The Genome is
3020-3320 nucleotides long (for the full length strand) and 1700 – 2800 nucleotides long (for short length strand) (Kay and Zoulim, 2007).

There are four known genes encoded by the genome, called C, X, P and S, each one encoding as specific structural protein.

- S gene, for the viral envelope surface antigen.
- C gene, for both the nucleocapsid (core) antigen and the pre-core (e) antigen.
- X gene, for two regulatory protein required for HBV replication
- P gene, for DNA polymerase (Weel and Tiollais, 1999).

2.1.3. Genotypes of HBV

Eight genotypes of HBV have been identified (Gish and Gadano, 2006). Genotypes differ by at least of their sequences and were first reported in 1988 when six were initially described (A – F) (Norder et al., 1994).

Two types have been described (G and H). genotype G has insertion of 36 nucleotides in the core gene (Stuyver, et al., 2000).

The genotypes have a distinct geographical distribution and are used in tracing the evolution and transmission of the virus. Differences between genotypes affect the disease severity, course and likelihood of
complications, and response to treatment and possibly vaccination (Magnius and Norder, 1995).

2.1.4. Serotypes of HBV

The virus is divided into four major serotypes (adr, adw, ayr, ayw) based on antigenic epitopes presented on its envelope proteins, and into eight genotypes (A – H) according to overall nucleotide sequence variation of the genome. (Kramvis et al., 2005).

HBV display a wide genetic diversity. Although it has several unique features that result in much higher mutation rate than usually observed for DNA viruses. (Oglou and Ueneke, 2009).

2.1.5. Replication of HBV

The life cycle of HBV is complex. Hepatitis B virus is one of a few known non-retroviral viruses which use reverse transcription as a part of its replication process. The virus gains entry into the cell by binding to an unknown receptor on the surface of the cell and enters it by endocytosis. Because the virus multiplies via RNA made by a host enzyme, the viral genomic DNA has to be transferred to the cell nucleus by host proteins called chaperones. The partially double stranded virus DNA is then made fully double stranded and transformed into covalently closed circular DNA (CCC DNA) that serves as a template for transcription of four viral mRNA. The largest mRNA (which is longer
than the viral genome), is used to make new copies of the genome and to make the capsid core protein and the viral DNA polymerase. The four viral transcript undergo additional processing and go on to form progeny virions which are released from the cell or returned to the nucleus and recycled to produce even new copies (Beck and Nassal, 2007).

2.2. Reservoir

Human is the only reservoir for HBV (WHO, 2010).

2.3. Incubation period

The incubation period of hepatitis B is 45 – 180 days with an average of 60 – 90 days. HBV can be detected in 30 – 60 days after infection and persist for a widely variable periods of time. Time to detection of hepatitis B surface antigen (HBs Ag) can be as short as two weeks or as long as six to nine months, depending on inoculum, host factors and other variables (WHO, 2009).

2.4. Infectious period

The blood of infected person is infective many weeks before the onset of symptoms and remain infective through the acute clinical course of the disease and during the chronic carrier state which persist for life. The proportion of infected individuals who become carriers is inversely related to their age at which infection occurs. Persons who are HBV DNA positive are highly infectious.
2.5. Epidemiology of HBV infection

The prevalence of chronic HBV infection varies greatly in different parts of the world. The prevalence of chronic HBV infection could be categorized as high, intermediate and low endemicity. The age at the time of infection is associated with the endemicity of HBV infection (Margolis et al., 1991).

2.5.1. High endemicity

The prevalence of HBV infection varies markedly highly endemic in developing regions with large population such as South East Asia, China, sub-Saharan Africa and the Amazon Basin, where at least 8% of the population are HBV chronic carrier. In these areas, 70–95% of the population shows infections occur during infancy or childhood. Since most infections in children are asymptomatic, there is little evidence of acute disease related to HBV, but the rates of chronic liver disease and liver cancer in adults are high (Alter, 2003).

2.5.2. Intermediate endemicity

Hepatitis B is moderately endemic in part of Eastern and Southern Europe, the Middle East, Japan, and part of South America. Between 10–60% of the population have evidence of infection, and 2-7% are chronic carriers. Acute disease related to HBV is common in these areas because many infections occur in adolescents and adults; however, the high rates
of occurring in infants and children (Toukan, 1990). In these areas, mixed patterns of transmission including infant, early childhood and adult transmission

2.5.3. Low endemicity

The endemicity of HBV is low in most developed areas, such as North America, Northern and Western Europe and Australia. In these regions, HBV infects 5–7% of the population, and only 0.5–2% of the population are chronic carriers. In these areas, most HBV infections occur in adolescents and young adults (Mcquillan et al., 1989).

2.6. High-risk groups including

- Injection drug user.
- Homosexual males.
- Health care workers.
- Patients who require regular blood transfusion or hemodialysis
- Infant born to infected mother.
- Sexual household contact of infected person.
- People sharing unsterile objects.
- People providing or receiving acupuncture and/or tattooing with unsterile medical devices.
- Sexual active heterosexual.
- People living in regions or travel to regions with endemic hepatitis B (Macmahon et al., 1985).

![Map showing distribution of Hepatitis B Virus infection worldwide.](image)

**Figure 1.1 Distribution of Hepatitis B Virus Infection World Wide**

(WHO, 2002)

2.7. **Transmission of HBV**

HBV spreads through contact with infected body fluids and the only natural host is human. Blood is the most important vehicle for transmission, but other body fluids have also been implicated, including semen and saliva (Scott et al., 1980).

Currently, three modes of HBV transmission have been recognized:
Perinatal, sexual, parenteral/percutaneous transmission. There is no reliable evidence that airborne infections occur and feces are not source of infection. HBV is not transmitted by contaminated food or water, insects or other vectors.

2.7.1. Perinatal transmission

Transmission of HBV from carrier mothers to their babies can occur during the perinatal period, and appears to be the most important factor in determining the prevalence of the infection in high endemicity areas particularly in China and Southeast Asia. Before HBV vaccine was integrated into the routine immunization program, the proportion of babies that become HBV carriers is about 10-30% for mothers who are HBsAg-positive but HBeAg-negative. However, the incidence of perinatal infection is even greater, around 70-90%, when the mother is both HBsAg-positive and HBeAg-positive (Seven et al., 1977)(Xu et al., 1985).

There are three possible routes of transmission of HBV from infected mothers to transplacental transmission of HBV:

1. In utero; natal transmission during delivery; or,
2. Postnatal transmission during care or,
3. Through breast milk.
Since transplacental transmission occurs antenatally, hepatitis B vaccine and HBIG cannot block this route. Epidemiological studies on HBV intrauterine infection in China showed that intrauterine infection occurs in 3.7-9.9% of pregnant women with positive HBsAg and in 9.8-17.39% with positive HBsAg/HBeAg (Xu et al., 1999) and it was suggested that a mother with positive HBeAg and a history of threatened premature labor are the main risk factors for intrauterine infection. The studies on hemagenous route: a certain of factors, such as threatened abortion, can make the placental micro vascular broken, thus the high-titer HBV maternal blood leak into fetus'circulation (Lin et al., 1987) (Ohto et al., 1987)

The transplacental transmission of HBV suggested two possible mechanism

1- placental tissue is infected by high-titer of HBV in maternal blood from mother's side to fetus' circulation step by step, and finally, HBV reach fetus 'circulation through the villous capillary endothelial cells (Xu et al., 1998).

2- For neonates and children younger than 1 year who acquire HBV infection perinatally, the risk of the infection becoming chronic is 90% presumably because neonates have an immature immune system. One of
the possible reasons for the high rate of chronicity is that transplacental passage of HBeAg may induce immunological tolerance to HBV in fetus.

2.7.2. Sexual transmission

Sexual transmission of hepatitis B is a major source of infection in all areas of the world, especially in the low endemic areas, such as North America. Hepatitis B is considered to be a sexually transmitted disease (STD). For a long time, homosexual men have been considered to be at the highest risk of infection due to sexual contact (70% of homosexual men were infected after 5 years of sexual activity) (Alter, 2003). However, heterosexual transmission accounts for an increasing proportion of HBV infections. In heterosexuals, factors associated with increased risk of HBV infection include duration of sexual activity, number of sexual partners, history of sexually transmitted disease, and positive serology for syphilis. Sexual partners of injection drug users, prostitutes, and clients of prostitutes are at particularly high risk for infection (Alter and Mast, 1994).

2.7.3. Parenteral/ percutaneous transmission

The parenteral transmission includes injection drug use, transfusions and dialysis, acupuncture, working in a health-care setting, tattooing and household contact. In the United States and Western Europe, injection drug use remains a very important mode of HBV
transmission (23% of all patients) (Margolis, et al, 1991). Risk of acquiring infection increases with duration of injection drug use. Although the risk for transfusion-associate HBV infection has been greatly reduced since the screening of blood for HBV markers and the exclusion of donors who engage in high-risk activities, the transmission is still possible when the blood donors are asymptomatic carrier with HBsAg negative and possibly with HBS Antibody positive (Occult Hepatitis) (Luo et al., 1993).

2.7.4. **Obvious sources of infection include**

HBV-contaminated blood and blood products, with contaminated surgical instruments and utensils being other possible hazards.

Parenteral/percutaneous transmission can occur during surgery, after needle-stick injuries, intravenous drug use, and following procedures such as ear piercing, tattooing, acupuncture, circumcision and scarification.

The nosocomial spread of HBV infection in the hospital, particularly in dialysis units, as well as in dental units, has been well described, even when infection control practices are followed. As with other modes of transmission, high viral titers have been related to an increased risk of transmission.
People at high-risk of infection include those requiring frequent transfusions or hemodialysis, physicians, dentists, nurses and other healthcare workers, laboratory technicians, intravenous drug users, police, firemen, laundry workers and others who are likely to come into chronicity is low (less than 5%) for transmission through sexual contact, intravenous drug use, acupuncture, and transfusion (Hyams, 1995).

Individuals at risk for these transmission modes usually acquire HBV infection during adolescence or adulthood without immune tolerance. Instead, the disease progresses directly to the immune clearance phase and is of short duration, which probably accounts for high spontaneous recovery

2.7.5. Modes of HBV transmission in healthcare setting

The principle modes of HBV transmission in healthcare setting are:-

1-Direct precutaneous inoculation of blood or body fluids containing HBV via needle-stick, or other injuries from sharp instruments.
2-Direct inoculation of blood or body fluids containing HBV to mucous membranes, cutaneous scratches, abrasion burns, other lesions
3-Indirect inoculation of HBV from environmental surface contaminated with blood or body fluids onto mucous membranes, cutaneous scratches, abrasions or other lesion (Bond et al., 1981)

2.7.5.1. Patient to healthcare worker transmission of HBV infection

Injuries from needles contaminated with HBV infected blood, one of the most efficient means of HBV transmission in healthcare setting. The average volume of blood inoculated during a needle-stick injury is sufficient to contain up to 100 infectious doses of HBV (Napoli and MaGwan, 1987).

Although overt percutaneous injuries are one of the most efficient modes of HBV transmission, these exposure probably account for only minority of HBV infection among healthcare workers (Roserberg et al., 1973).

Multiple factors influence the risk of HBV infection among healthcare workers including:

1- The prevalence of HBsAg positively in the general and patient population.

2- The prevalence of immunity to HBV due to natural infection or immunization among healthcare workers.
3-The frequency with which HBsAg-positive exposure occur in the occupational setting (Alter, 2003)

2.7.5.2. Healthcare worker to patient transmission of HBV

The vast majority of healthcare personnel infected with blood borne virus do not pose a risk to patient because they do not perform activities where conditions necessary for transmission are met (Chiarell, 2001).

Three conditions are necessary to healthcare personnel to pose a risk for blood borne virus transmission to patients;- 

1-The healthcare provider must be viremic (i.e have infectious virus circulating in blood stream)
2-The healthcare provider must be injured or have a condition (e.g weeping dermatitis) that allows direct exposure to his or her blood or other infectious body' fluids
3-The provider's blood or infectious body' fluids must gain direct access to a patient's wound, mucous membranes or similar portal of entry (Gurson et al., 2003).

Although an infected healthcare provider might be viremic , unless the second and the third conditions are both met, transmission can not occur.
Specific factors influencing the transmission of HBV to patients have included:

1. The presence of high level of virus.
2. The performance of exposure prone invasive procedures.
3. The presence of other conditions allowing access to the worker’s blood (Chiarell, et al., 2001).

30% of reported hepatitis B among adults cannot be associated with an identifiable risk factor (Shapiro, 1993).

Because HBV replicates profusely and produce high titer in the blood (10^8 – 10^10 virions/ml) any parenternal or mucosal exposure to infected blood poses a high risk of HBV acquisition (Mast and Alter, 1993).

Worldwide, perinatal (vertical) transmission is predominant mode of HBV transmission. Whereas intravenous drug abuse and unprotected sexual intercourse are the main routes of infection in areas of low prevalence such as United States. In sub-Saharan African, Alaska and Mediterranean countries transmission of HBV usually occurs horizontally during childhood, presumably via contact with non-intact skin (Macmahon et al., 1985).

Saliva has also been though to be the route of HBV transmission in sporadic cases through human bites (Hui et al., 2005).
The HBV carrier rate is 1-20% worldwide and this variation is related to differences in the mode of transmission and age at which the infection occurs (Ogbou and Ueneke, 2009).

2.8. Pathology of HBV

HBV enters the body on the blood stream and targets hepatocytes, presumably since its receptor is found predominantly on these cells. There is little cytopathic effect and the rate at which symptoms appear depends on the initial dose at the virus. The incubation period is 60–90 days (range 45–180 days). Although virus replication start a few days after infection. The first sign of infection is the characteristic appearance of HBsAg in infected cells (ground glass appearance). As with other hepatitis viruses. The symptoms are immune-mediated, resulting from inflammation and cell mediated (cytotoxic cell) responses to HBsAg on the surface of hepatocytes. These resolve the disease. (Hunt, 2009).

If the cell – mediated immune response is weak, symptoms are mild but the infection does not resolve and chronic hepatitis ensues. This is frequently the case with younger patients who have lesser cell-mediated immunity (Hunt, 2009)
2.9. Symptoms

Symptoms will vary from patient to patient according to their age and immunity to disease. However, most will be experienced in varying degrees of severity. (Reynard, 2002).

Half of people infected with HBV have no symptoms and may never realize that they have been asymptomatic. Adults are more likely to develop symptoms than children. For those who get sick, symptoms usually develop within 1-4 months after exposure to the virus. (Nettleman, 2001).

Signs and symptoms of hepatitis B virus infection are similar for different types of hepatitis, progress in several stages:

2.9.1. The predromal (Preicteric) stage

The patient typically complains of easy fatigue and anorexia (possibly with mild weight loss), generalized malaise, depression, headache, weakness, arthralgia, myalgia, photophobia and nausea with vomiting. He may also describe changes in his senses of taste and smell, assessment of patient’s signs may reveal a fever of 100° to 102°F (37.8° - 38.9°). the prodromal stage ends usually 1 – 5 days before the onset of the clinical jaundice stages (Collins, 2003).
2.9.2. Clinical jaundice stage

If the patient has progressed to clinical jaundice stage, he may report pruitus, abdominal pain or tenderness and indigestion. Early in this stage, he may complain of anorexia and his appetite may return. Inspection of sclera, mucous membranes, and skin may reveal jaundice, which can last for 1-2 weeks. Jaundice indicate that the damaged liver is unable to remove bilirubin from the blood, however, its presence doesn't indicate the severity of the disease. Occasionally hepatitis occurs without jaundice.

During the clinical jaundice stage, inspection of skin may detect rashes, erthematous patches or urticaria especially if the patient has hepatitis B or C. Palpation may disclose, abdominal tenderness in the right upper quadrant, an enlarged and tender liver, and in some cases, splenomegaly and cervical adenopathy (Spring house, 2003).

2.9.3. Recovery stage (Posticteric stage)

During this stage, most of the patients' symptoms decrease or subside. On palpation, a decrease in liver enlargement may be noted.

The recovery phase commonly lasts from 2 – 12 weeks, although sometimes this phase lasts longer in patients with B, C or E. (Collins, 2003).
2.10. Hepatic encephalopathy: signs and symptoms

Clinical manifestation of hepatic encephalopathy vary, depending the severity of the neurologic involvement, and develops in four stages.

Encephalopathy is usually graded by behavioral changes being the most approved indicator.

2.10.1. Prodormal stage

Mood fluctuation, sleep-wake, reversal, forgetfulness, commonly over looked because early symptoms, such as slight personality changes, disorientation, slurred speech and slight tremor, are subtle (Spring house, 2003).

2.10.2. Impeding stage

Disorientation, confusion, may be incontinent, tremor progressing to a sterixis. The hallmark is characterized by quick, irregular extension and flexions of the wrists and fingers. When the wrists are hold out straight and hands flexed upward. Lethargy, aberrant behavior and apraxia also occur.

2.10.3. Stuporous stage

Hyperventilation, patient is stuporous but noisy and abusive when aroused.
2.10.4 Coma - stage

Hyperactive reflexes, a positive Babinski's sign, fever hepatiticus (musty, sweet breath odor) and coma (Spring house, 2003).

2.11. Clinical manifestation of HBV

HBV infection, acute or chronic has a variable manifestation. During the acute stage, HBV infection can manifest as anicteric [subclinical] hepatitis, icteric hepatitis or rarely acute fulminant hepatitis. Chronic HBV infection can be a symptomatic or it can be manifested by symptoms and signs of cirrhosis or hepato cellular carcinoma or both. (Caconb et al., 2005).

2.11.1. Acute hepatitis B

The consequences of acute HBV infection are highly variables. The incubation period ranges form 6 weeks to 6 months and development of clinical manifestation is highly age dependent. Newborns generally do not develop any clinical signs or symptoms, and infection produces typical illness in only 5 – 15% of children 1-5 years of age. Older children and adults are symptomatic in 33 – 50% of infection (Mahoney, 1999).
The initial features of infection are non-specific flu-like symptoms and may include malaise, muscle and joint aches, fever, nausea or vomiting, diarrhea and headache. More specific symptoms, which can present in acute hepatitis are profound loss of appetite, dark urine, yellowing of eyes and skin (Jaundice) and abdominal discomfort (Chang, 2007).

In the acute phase, ALT and AST level rise, bilirubin levels also rise, usually after the ALT level does. Although the peak ALT level reflects the hepatocellular injury, it has no prognostic value with recovery. ALT level normalize in 1 – 4 months (Schiodt et al., 1999).

2.11.2. Chronic hepatitis B

Chronic hepatitis B virus infection is defined as the presence of HBsAg in serum for at least 6 months or presence of HBsAg and absence of anti-HBs Immunoglobulin M (IgM). The risks of developing chronic infection varies inversely with the age and is highest (up to 90%) to infant infected in perinatal period. 25-50% of infected children between 1 – 5 years of age develop chronic infection, compare to 10% of acutely infected older children and adults, (Mahony, 1999). Many patients with chronic HBV infection have no symptom or have no specific symptoms such as fatigue or right upper quadrant discomfort. Acute exacerbations
due to HBV e antigen seroconversion (i.e. in which e antigen reappears) occasionally occur in patient with chronic hepatitis B. Most of these exacerbations are asymptomatic, but occasionally an acute hepatitis like clinical picture with detectable IgM antibody against core antigen occurs, leading to misdiagnosis of acute hepatitis B virus infection in patients not previously known to have chronic HBV infection (Chu et al., 1989).

Persons with chronic HBV infection are generally classified as having one of three histologic patterns or liver biopsy; chronic persistent hepatitis, chronic active hepatitis and cirrhosis. The degree of histologic injury is often not reflected by symptoms and persons with severe chronic disease are often asymptomatic until the development of cirrhosis (Mahony, 1999).

In chronic hepatitis B, liver enzyme levels can be normal, even in patients with well compensated cirrhosis ALT levels may range from normal to five times higher than normal. Thrombocytopenia, hypoalbuminemia, direct albuminemia and prolonged prothrombin time suggest cirrhosis. Finding of chronic hepatitis B on liver biopsy range from minimal inflammation to cirrhosis. The most characteristic histologic feature of chronic HBV infection is the "ground-glass hepatocyte' which is due to intracellular accumulation of HBsAg (Gerber, 1974).
Once HBV infection become chronic, it may never go away completely. Approximately 70 – 90 of infected adults are able to fight off the virus so their infection is cured, it about 5 – 10% of infected adult go on to develop chronic infection (Nettleman and El-Mortuda, 2011).

2.12. Natural history of HBV infection

HBV is a major cause of acute and chronic hepatitis, cirrhosis and primary hepato cellular carcinoma worldwide. (WHO, 2010).

HBV surface antigen (HBsAg] can be detected in the blood approximately 2-4 weeks after inoculation. Simultaneously, HBV DNA usually is very high levels, is also detected in the blood. However, in the cases of acute fulminant hepatitis, HBV DNA levels, can be low or undetectable at the time of presentation because the immune system mounts a robust response with extensive damage to HBV infected hepatocytes. (Carey, 2009).

The rate of spontaneous recovery from acute HBV infection varies, depending on the patient's age at the time of HBV acquisition and the patient's immune status. Fewer than 5% of immune complement adults infected with HBV remain chronically infected, defined as being positive for HBV surface antigen for more than 6 months, on the other hand, 6 – 10% of infected adults and about 25% of infected children aged to 1 – 5
years and 70 – 90% of infected infants remain chronically infected (McMahon et al., 1985).

2.12. Phases of chronic HBV infection

Four phases of chronic HBV infection. Although all patients do not go through all phases (Yim and Lok, 2006). HBV surface antigen is detectable in all patients.

2.12.1. The immune tolerance phase

The initial phase of chronic HBV infection is seen almost exclusively in those who acquired HBV infection vertically or during early childhood. Although patients have high HBV DNA levels, they do not have significant liver disease. This discrepancy to be related to the immune tolerance to HBV, however, the exact mechanism of that tolerance is unclear (Pung Papong, 2007).

Only 15% of those with immune tolerance have spontaneous HBV e antigen seroconversion (i.e. loss of "e" antigen and appearance of anti-e-antibody) within 20 years after infection (Pung Papng, 2007).

The duration of this stage for healthy adults is approximately 2- 4 weeks and represent the incubation period. For newborns, the duration of this period often is decades. Active viral replication is known to continue
despite little or no elevation in aminotransferase levels and no symptom of illness (Seeger and Mason, 2000).

2.12.1.2. The immune clearance phases

(HBV e antigen positive chronic hepatitis), appears about 20 – 30 years after the onset of immune tolerance phase in patients who acquired HBV early in life. It is also often seen in patients with infections acquired late in childhood or adult hood.

This phase marks the start of an immune mediated process aimed to clearing viral infection, but it also leads to concomitant hepato cellular injury. Spontaneous clearance of the "e" antigen increases in this phase to an annual rate 10-20% (Lok et al., 1987).

The strongest predictors of spontaneous e antigen seroconversions are old age, and elevated ALT level and an acute exacerbations) (Caconb, et al., 2005).

Although ALT levels are elevated and there is evidence on liver biopsy of chronic active hepatitis, this phase is usually asymptomatic. Rarely however, it presents with an acute flare of hepatitis, sometimes accompanied by IgM antibodies against the HBV core antigen (in low titre) leading to incorrect diagnosis of acute HBV infection.
Depending on the duration of chronic hepatitis and the frequency and severity of flares, about 12 – 20% of patients in the immune – clearance phase develop serious liver disease within 5 years (Pung Papong et al., 2007).

In this phase, an inflammatory reaction with cytopathic effect occurs. HBeAg can be identified in the sera, and a decline in the level of HBV DNA is seen. The duration of this phase for patient with acute infection is approximately 3 – 4 weeks (symptomatic period). For patients with chronic infection 10 years or more may be elapse before cirrhosis develops (Hunt, 2009).

2.12.1.3 . The inactive carrier phase

Following HB e antigen seroconversion, is characterized by undetectable or low HBV DNA level (< 1.000 copies 1ml), normal ALT levels and minimal or no necro-inflammatory on liver biopsy (Yim and Lok, 2006). Such patients should be followed within serial testing as 4 - 20% of them spontaneously revert to being positive for e antigen at least once (Lok and Mcmahon, 2007). On the other hand only 0.5 – 2% of surface antigen carriers in western countries clear themselves of surface antigen yearly, but up to half of those who clear the surface antigen have low level HBV virmia.
In this phase, the host can target the infected hepatocytes and the viral replication no longer occurs. Also an integration of the viral genome into the hosts hepatocyte genome takes place. HBs Ag still present (Chan and Lok, 1999).

2.12.1.4. The Reactivation phase

(HBV e antigen negative chronic hepatitis). Is seen in some HBV – infected patients, especially those from Asia and southern Europe, in whom the virus has spontaneous pre-core or core mutation that makes infected cells unable to secrete the e antigen. Although those patients have no e antigen in their blood, they have intermittent or persistent elevation of ALT, elevated by HBV DNA, and histopathologic findings of chronic hepatitis compared with those in the immune clearance phase, patients in the reactivation phase tend to be older and to have lower HBV DNA, but advanced hepatitis damage (Yim and Lok, 2006).

In this stage, the virus can not be detected and antibodies to various viral antigens have been produced. Different factors have been postulated to influence the evolution of these stages including age, sex, immune-suppression and co-infection with other viruses (Pyrsopoulos, 2007).

One of the reasons for chronic HBV infection is that the virus cause chronic non cytoidal infection of hepatocytes, the principal cell
type of the liver – hepatocytes continuously shed the virus into bloodstream, ensuring that 100% of hepatocytes population is infected. Also hepatocytes are normally long-lived, with half-lives estimated at 6 – 12 months or longer. The combination of a long-lived, usually non-dividing host cell and a stable virus host cell interaction virtually ensures the persistence of an infection in absence of a robust host immune response (Seeger & Mason, 2000).

2.13. Progress of HBV infection

The acute illness usually subside after 2 – 3 weeks, and the liver usually returns to normal with 16 weeks. Some infected people develop chronic hepatitis B and remain infectious and are considered carriers of the disease, even if they do not have any symptoms (Lin, 2004).

Chronic hepatitis B infection significantly increase the risk for liver damage including cirrhosis and liver cancer.

In fact, hepatitis is the leading cause of liver cancer worldwide – liver cancer is the main cause of death in people with chronic hepatitis B (Simon and Zieve, 2008).

Factors influence disease progression:

- Host factors (age at infection, gender, immune-status)
-Viral (viral load, genotype, mutations)
-External (concurrent viral infection, alcohol consumption, chemotherapy) (Wright, 2006).

2.14. Complications of HBV infection

Most individuals with chronic hepatitis remain symptom-free for many years or decades. During this time, the patient's blood tests are usually normal or only mildly abnormal, some patients may deteriorate and develop inflammation symptoms, putting them at risk for developing cirrhosis, liver failure and hepatocellular carcinoma (Nettleman, 2010).

2.14.1. Cirrhosis

Is defined as an extensive scarring of liver, that impair the liver's ability to function. Symptoms may include:

- Weakness
- Fatigue
- Loss of appetite
- Weight loss
- Breast enlargement in men
- A rash on palms
• Difficulty with blood clotting

• Spider – like blood vessels or the skin

• Decreased absorption of vitamin A and D can cause impaired vision night and thinning of bones.

Patients with liver cirrhosis also are at risk of infections because the liver play an important role in immune system (Lin, 2004).

2.14.2. Liver Failure

Is correlation in which all the vital functions of the liver shut down. It is a life threatening condition. Several complications occur such as:

• Confusion and even coma

• Decrease in production of clotting factor and some times bleeding

• Jaundice

• Increased pressure in blood vessels of the liver

• Kidney failure

• Enlarged spleen

• Anaemia
• Increased risk of infection (AMLF, 2009).

2.14.3. Hepato cellular carcinoma (HCC)

A number of HBV patients with chronic hepatitis will develop (HCC). Persons at increased risk of developing HCC, who contracted hepatitis B in early childhood. Only 5% of patients with cirrhosis develop HCC, on other hand, between 60 – 90% of HCC patients have underlying cirrhosis (Robin-son, 1994).

HBV causes 60 – 80% of the world's primary liver cancer. symptom of liver cancer are non specific. Patient may have no symptom or they may experience abdominal pain and swelling, enlarged liver, weight loss and fever. (Lin, 2004). When HCC presents clinically, the disease is fatal. The median survival frequency of HCC patients is less than 3 months. However, if the liver cancer is detected early, there is 85% chance of cure. Treatment involves surgery, hepatic irradiation and anti-cancer drugs (Robinson, 1995).

2.14.4. Fulminant hepatitis B

Fulminant hepatitis B is a rare condition that develops in about 1% of cases. It is caused by massive necrosis of liver substance and is usually fatal (Hollinger and Liang, 2001).

Survival in adults is uncommon. Patients infected with pre core mutants, often manifest severe chronic hepatitis, early progression with
cirrhosis, and a variable response to interferon therapy. It may have association with fulminant hepatic failure. (Zukerman, 1996).

Genetic heterogeneity of HBV, coinfection or super infection with other viral hepatitis agents, or host immunological factors, may be associated with development of fulminant hepatitis B. (Robinson, 1995).

A rapid fall in ALT and AST in patients with fulminant hepatic failure may be interpreted as resolving hepatic infection, when in fact hepatocytes are being lost and the outcome is fatal. (Hollinger and Liang, 2001).

2.14.5. Extra-hepatic manifestation hepatitis B

Rarely, chronic hepatitis B infection can lead to disorder that affect organs other than liver. These conditions are caused when the normal immune response to hepatitis B mistakenly attacks uninfected organs. Among these conditions are:

- Polyarteritis nodosa:

  A disease characterized by inflammation of small blood vessels throughout the body. This condition can cause a wide range of symptoms including, muscle weakness, nerve damage, deep skin ulcers, high blood pressures causes fluids to build up in the abdominal cavity (ascites) and may result in engorged vein in the swallowing tube that tear easily and may cause massive bleeding. Portal
hypertension can also cause kidney failure, enlarged spleen, anemia, unexplained fever and abdominal pain. (Nettleman, 2011).

- Membranous glomerulonephritis:

  Is present in both adults and children. Remission of nephropathy occurs in 85 to 90% of cases over a period 9 years and is associated with clearance of HBeAg from serum.

- Hepatitis D infection:

  Hepatitis D virus is a detective virus, that is only infection in the presence of active HBV infection (WHO, 2011).

2.15. Diagnosis of hepatitis B virus (HBV)

  The tests, called assays, for detection of HBV infection involve serum or blood tests that detect either viral antigens(proteins) produced by the virus or antibodies produced by the host in response to HBV infection and others detect viral DNA. (Bonino et al., 1987).

  The sensitive serologic techniques used to detect these markers in blood and sera of suspected individuals are :-

  - Immune Chromatographic Test (ICT).
  - Enzyme-Linked Immuno Sorbent Assay (ELISA).
2.15.1. Serological markers of HBV infection:

2.15.1.1. HBsAg

It is the first detectable viral antigen appear on the surface of HBV. It can be detected in high levels in serum during acute or chronic hepatitis, for several weeks before onset of symptoms to month after onset. The presence of HBsAg indicate that the person is infectious. The body normally produces immune response to infection (CDC, 2006).

HBsAg may be undetectable later in the infection as it is being cleared by the host (Locarnini, 2004).

2.15.1.2 Anti HBs

The presence of (anti-HBs) is generally interpreted as indicating recovery and immunity from HBV infection. Anti-HBs also develops in
a person who has been successfully vaccinated against hepatitis B (CDC, 2006).

The time between the removal of HBsAg and the appearance of anti-HBs is called window period. Individual who remain HBs Ag positive for at least six months are considered to be hepatitis B carrier (Lok and McMahon, 2007).

2.15.1.3. HBcAg

Infectious virion contains an inner "core particle" enclosing viral Genome. The icosahedral core particle is made of 180 or 240 copies of core protein. During this "window" in which the host remains infected but is successfully cleaning the virus (Zuckerman, 1996).

2.15.1.4. IgM anti-HBc

Positively indicate recent infection with HBV (less than 6 months). It's presence indicates acute infection (CDC, 2006).

2.15.1.5. HBe Ag

A secreted product of the nucleocapsid gene of HBV and is found in serum during acute and chronic hepatitis B. Its presence indicate that the virus is replicating in the infected individual and a high level of HBV (CDC, 2006).
It appears after the appearance of HBsAg. During the natural course of infection, HBeAg may be cleared, and antibodies to the "e" antigen will rise immediately afterwards. This conversion is usually associated with dramatic decline in viral replication (Zukerman, 1996).

2.15.1.6. HBe Ab or Anti-HBe

Produced by immunity temporally during acute HBV infection or consistently during or after a burst in viral replication.

If the host is able to clear the infection eventually the HBsAg will become undetectable and will be followed by IgG antibodies to and HB core antigen (Zukerman, 1996).
2.15.1.7. Interpretation of HBV serological lab-results

<table>
<thead>
<tr>
<th>Test</th>
<th>Results</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBs Ag</td>
<td>Negative</td>
<td>Susceptible</td>
</tr>
<tr>
<td>Anti – HBs</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Anti - HBc</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HBs Ag</td>
<td>Positive</td>
<td>Immune due to natural infection</td>
</tr>
<tr>
<td>Anti – HBs</td>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td>Anti – HBc</td>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HBs Ag</td>
<td>Negative</td>
<td>Immune due to hepatitis B vaccination</td>
</tr>
<tr>
<td>Anti – HBs</td>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td>Anti – HBc</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HBs Ag</td>
<td>Positive</td>
<td>Acutely infected</td>
</tr>
<tr>
<td>Anti – HBc</td>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td>IgM – anti HBC</td>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td>Anti – HBs</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HBs Ag</td>
<td>Positive</td>
<td>Chronically infected</td>
</tr>
<tr>
<td>Anti – HBc</td>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td>IgM – anti -HBC</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td>Anti – HBs</td>
<td>Negative</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HBs Ag</td>
<td>Negative</td>
<td>Four interpretations possible</td>
</tr>
<tr>
<td>Anti – HBc</td>
<td>Positive</td>
<td></td>
</tr>
<tr>
<td>Anti – HBs</td>
<td>Negative</td>
<td></td>
</tr>
</tbody>
</table>

(CDC, 2006).
### 2.15.1.8. HBV serological markers in hepatitis B patients

The three standard blood tests for hepatitis B can determine if the person is currently infected with HBV, has recovered, chronic carrier, or is susceptible.

<table>
<thead>
<tr>
<th>Assay results</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>+</td>
<td>Early acute HBV infection</td>
</tr>
<tr>
<td>+</td>
<td>Acute or chronic HBV. Differentiate with IgM anti-HBc. Determine levels of infectivity with HBe Ag or HBV DNA</td>
</tr>
<tr>
<td>-</td>
<td>Indicate previously HBV infection; low level HBV carrier, time span between disappearance of HBs Ag and appearance of anti – HBs, or false positive or non specific reaction. And/or challenge with HBs Ag vaccine. When present, anti – HBe help validate the anti – HBc reactivity.</td>
</tr>
<tr>
<td>-</td>
<td>Another infectious Agent, toxic injury to the liver, disorder of immunity, hereditary disease of the liver, or disease of biliary tract.</td>
</tr>
<tr>
<td>-</td>
<td>Vaccine – type response</td>
</tr>
</tbody>
</table>

(Hollinger and Liang, 2001)
2.15.1.9. Serological test findings at different stages of HBV infection and in convalescence

<table>
<thead>
<tr>
<th>Stage of infection</th>
<th>HBs Ag</th>
<th>Anti-HBs</th>
<th>Anti – HBC</th>
<th>HBe Ag</th>
<th>Anti-HBe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Late incubation period</td>
<td>+</td>
<td>-</td>
<td>-</td>
<td></td>
<td>-/+</td>
</tr>
<tr>
<td>Acute hepatitis B or persistent carrier state</td>
<td>+</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>HBs Ag – negative acute hepatitis B infection</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
</tr>
<tr>
<td>Recovery with loss of detectable anti – HBs</td>
<td>-</td>
<td>-</td>
<td>+</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Chronic hepatitis B persistent carrier state</td>
<td>+</td>
<td>-</td>
<td>+++</td>
<td>+/-</td>
<td>+</td>
</tr>
<tr>
<td>HBV infection in recent past convalescence</td>
<td>-</td>
<td>++</td>
<td>++</td>
<td>+/-</td>
<td>-</td>
</tr>
<tr>
<td>HBV infection in distant past recovery</td>
<td>-</td>
<td>+/-</td>
<td>+/-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Recent HBV vaccination, repeated exposure to antigen without infection or recovery from infection with loss of detectable HBc</td>
<td>-</td>
<td>++</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

2.15.1.10. Discordant or unusual hepatitis B serological profiles requiring further evaluation

Repeat testing of same sample or possibly of an additional sample is advisable when test yield discordant or unusual results.

<table>
<thead>
<tr>
<th>Serological marker</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>HBs Ag positive/ anti – HBc negative</td>
<td>Negative reaction during the incubation period of acute hepatitis B, before the onset of clinical symptom and liver abnormality.</td>
</tr>
<tr>
<td>HBsAg positive/ anti – HBs positive/ anti – HBc positive</td>
<td>Uncommon may occur during resolution of acute hepatitis B, in chronic carriers who have serious liver diseases, or in carrier exposed to heterologous subtypes of HBs Ag.</td>
</tr>
<tr>
<td>Anti – HBc positive only</td>
<td>Past infection not resolved completely.</td>
</tr>
<tr>
<td>HBe Ag positive/ HBs Ag negative</td>
<td>Unusual</td>
</tr>
<tr>
<td>HBe Ag positive Anti – HBe positive</td>
<td>Unusual</td>
</tr>
<tr>
<td>Anti – HBs positive only in non immunized person</td>
<td>It may be a result of passive transfer of anti – HBs after transfusion of blood from vaccinated donor,in patients receiving clotting factor, after IG administration, or in newborn children of mothers with recent or past HBV infection. Passively acquired antibodies disappear gradually over 3 – 6 months , whereas actively produced antibodies are stable over many years. Apparently quite common when person has forgotten his/her immunization status.</td>
</tr>
</tbody>
</table>

(WHO, 2010)
Mutant protein from mutant HBV strains may escape diagnostic detection. The presence of different serological markers should therefore be tested for correct diagnosis. Diagnostic kits should contain antibodies against a variety of mutant protein, if perfection is the goal (WHO, 2010).

HBV infection is the major residual posttransfusion risk in developed countries because of the long window period. HBV mutants, the low viremia and very high infectivity (WHO, 2011).

Diagnosis of HBV is based on constellation of clinical, biochemical, histological and serological findings. A number of viral antigens and their respective antibodies can be detected in serum after infection with HBV, and proper interpretation of results is essential for the correct diagnosis of various clinical forms of HBV infection (Liang et al., 2002).

Diagnosis of hepatitis is made by biomedical assessment of liver function. Initial laboratory evaluation should include, total and direct bilirubin, ALT, AST, Alkaline phosphates and prothrombin time, total protein, albumin, serum globulin, complete blood count and coagulation studies. (WHO, 2011).
2.15.2.1. Bilirubin

Is the one of the most important factors indicative of hepatitis. It is a red yellow pigment that normally metabolized in the liver and then excreted in the urine. In patient with hepatitis, the liver can not process bilirubin, and blood levels of this substance rises, causing yellowish skin known as jaundice.

2.15.2.2. Liver enzymes aminotransferases

Enzymes known as aminotransferases, including, Aspartate (AST) and Alanine (ALT) are released when the liver is damaged. Measurements of these enzymes, particularly ALT, are the least expensive and most non invasive tests for determining severity of the underlying liver disease and monitoring treatment effectiveness. Enzymes levels vary, however, and are not always accurate indicator of disease progression to cirrhosis.

2.15.2.3. Alkaline phosphase( ALP)

High ALP level can indicate bile duct blockage.

2.15.2.4. Serum Albumin concentration

Serum albumin measures protein in the blood. Low levels indicate poor liver function.
2.15.2.5. **Prothrombin time (PT)**

The PT test, measures in seconds the time it takes for blood clots to form (the longer time it takes the greater risk for bleeding)

2.15.2.6. **Liver biopsy**

A biopsy, involves a doctor inserting a biopsy fine needle, guided by ultrasound, to obtain a small sample of the liver tissue. Local anesthetic is used to numb the area. Patients may feel pressure and some dull pain. The procedure takes about 20 minutes to perform (Simon and Zieve, 2008).

2.16. **Treatment of HBV infection**

Treatment of hepatitis B viral infection depends on how active the virus and whether there is a risk for liver damage. If any one have recently been exposed to HBV, he should receive a shot of hepatitis B immunoglobulin and the first shot of three immunization shots of hepatitis B vaccine.

It is important to receive this treatment within 7 days after a needle stick and within 2 weeks after sexual contact with an infected person. The sooner treatment after exposure is more effective treatment (Romito, 2009).
2.16.1. Treatment of acute HBV infection

If symptoms of acute hepatitis B appeared. Treatment with medicines is usually not needed. Home treatment usually will relieve symptoms and prevent spread of the virus. To help relieve symptoms and prevent spread of infection:

- Slow down, reduce activity level to match energy level.
- Get adequate nutrition
- Drink plenty of liquids, fruit juices and broth to obtain additional calories.
- Rehydration drinks help replenish electrolytes.
- Avoid alcohol and drugs that can make liver damage worse.

Medicines may be given to treat an acute HBV infection if:

- Tests continue to detect certain antigen (HBeAg) after 12 weeks.
- Liver enzyme level are higher than normal indicating some liver damage.
• The amount of HBV DNA is high, which means there is a lot of virus in the body (high viral load) (Lok and McMahon, 2007).

2.16.2. Treatment of chronic HBV infection

The goal of treatment is to stop liver damage by preventing the virus from multiplying. Antiviral medicine is used if the virus is active and there is a risk for liver damage. Medicine slow the ability of the virus to multiply (Simon and Zieve, 2008).

2.16.2.1. Antiviral therapy

Several antiviral medications are available to treat hepatitis B.

2.16.2.1.1. Lamivudine (Epi viv-HBV ®)

Is effective in decreasing HBV activity and ongoing liver inflammation. It is safe in patients with liver failure.

Lamivudine is taken by mouth, usually at dosage of 100mg/day. The major problem with lamivudine is resistant forms of HBV (mutants) frequently develop in people who take lamivudine long term.

2.16.2.1.2. Adefovir (Hepser ®)

Is taken by mouth, at dosage of 10mg/day, for at least one year. Most patients will need a long term treatment to maintain control of HBV. Adefovir is a weak antiviral medication and resistance does occur overtime.
2.16.2.1.3. **Entecavir (Baraclude ®)**

Is generally more potent than lamivudine and adefovir. Resistance to entecavir is uncommon in people who have never been treated with antiviral, but occurs in up to 58% of people who have used lamivudine.

It is taken by mouth at a dosage of 0.5 mg daily for patients who have no prior treatment and 1.0 mg daily for patients who have resistance to lamivudine (Lok, 2011).

2.16.2.1.4. **Tenofovir (Viread ®)**

Is more potent than adefovir. Resistance to tenofovir is rare, tenofovir is taken by mouth at a dosage of 300mg daily. It is effective in suppressing hepatitis B virus that is resistant to lamivudine or entecavir. Tenofovir is not effective in patients with adefovir – resistance hepatitis B.

2.16.2.1.5. **Telbivudine (Tyzeka ®)**

Is more potent than lamivudine and adefovir. Resistance to telbivudine is uncommon and HBV that resistant to lamivudine is also resistant to telbivudine. Telbivudine is taken by mouth at dosage of 600 mg daily.
2.16.2.1.6. **Interferon alpha**

Is an appropriate for people with chronic hepatitis B infection who have a detectable virus activity, ongoing liver inflammation and no cirrhosis. Drug resistance to interferon has not been reported. Interferon alpha is taken by injection (Lok, 2011). The recommended regimen is either 5 million units daily or 10 million units three times a week, given subcutaneously for 4 months. (Mahoney, 1999).

2.16.2.1.7. **Pegylated interferon**

A long acting interferon taken once a week, is given for one year. This is in contrast to other hepatitis treatments which are given for many years until a desired response is achieved.

Antiviral therapy is not recommended for everyone has a chronic hepatitis B viral infection. The doctor may recommend antiviral if there is liver damage, such as cirrhosis (Romito, 2009).

American Association for the study of liver disease has made recommendations for treatment of chronic HBV infection. These recommendations are based on the presence of hepatitis B antigens in the blood, level of HBV DNA in the blood and the levels of liver enzymes. Treatment with antiviral medicine is recommend if:-

- HBe Ag positive and have high levels of HBV DNA and liver enzymes are more than twice the normal level.
- HBe Ag negative and have lower level of HBV DNA and liver enzymes are more than twice the normal level.

-Either HBe Ag positive or negative and have high level of HBV DNA and have cirrhosis.

Treatment with antiviral medicine is not recommended if:

- HBe Ag positive and have high levels of HBV DNA, and liver enzymes are less than twice the normal level.

- HBe Ag – negative, and have low levels of HBV DNA, and liver enzymes are less than twice the normal level (Romito, 2009).

These antiviral drugs block the replication of HBV in the body. They may also prevent the development of progressive liver disease (cirrhosis and liver failure) and development of liver cancer.

A doctor will decide which drug to prescribe based on the patient's age, disease severity and other factors. Each drug has various advantages and disadvantages in terms of cost, efficacy, side effects, and likelihood drug resistance (Simon and Zievce, 2008).
Patient with chronic hepatitis B should seek the advice of an internal medicine doctor or specialist who has experience in treating hepatitis B.

Once the patient start treatment he will have regular monitoring to see how is the treatment working, monitor for side effects or drug resistance, and monitor for signs that the infection has come back after finishing treatment.

### 2.16.2.2. Liver transplantation

Liver transplantation may be the only option for people who have developed advanced cirrhosis. Liver transplantation process is elaborate, involving an extensive screening process to ensure that a person is a good candidate. Thus, not all patients with cirrhosis are eligible, and it is preserved only in those with most advanced cirrhosis or early stage of liver cancer. (Lok, 2011).

### 2.17. Prevention of HBV infection

Three main strategies are available for prevention of HBV infection:

#### 2.17.1. Behavior modification:

Changes in sexual practices and improved screening measures of blood products have reduced the risk of transfusion-associated hepatitis.
Behavior modification is thought to 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, immune prophylaxis, both passive and active will be more effective.

2.17.2. Passive immunization

In 1974, a special high titred human hepatitis B immune globulin designated HBIG was introduced. HBIG protects by passive immunization if given shortly so sooner after exposure to HBV, the protection is immediate, but it last only 3 – 6 month. HBIG is not recommended as protective prophylaxis, because of the high cost, limited availability and short term effectiveness. (WHO, 2010).

2.17.3. Active immunization

Hepatitis B is a vaccine preventable disease, when the vaccine was first introduced in 1982s. It was recommended for high risk groups. However, the number of cases of hepatitis B continued to increase after the vaccine was introduced. In 1991` universal infant immunization was instituted followed by recommendation for catch –up of adolescents in 1996 (WHO, 2001).

The implementation of routine infants immunization will eventually produce broad population – based immunity to HBV transmission among all ages. (Mahoney, 1999).
In March 2002, 151 countries have introduced hepatitis B vaccine within their national immunization program (WHO, 2002).

In Sudan vaccination to HBV was included as a part of the extended program of immunization in 2005 (Mudawi, 2007).

In December, 2006, 164 countries vaccinated infants against hepatitis B during national immunization programs, compared with 31 countries in 1992. The year at which world health assembly passed a resolution to recommend global vaccination against hepatitis B (WHO, 2011).

Hepatitis B vaccines have been commercially available in United State since 1981. hepatitis B vaccines are composed of highly purified preparation of HBsAg. The vaccines are prepared either by harvesting HBsAg from plasma of person with chronic infection or by inserting plasmid containing the HBs gene into yeast or mammalian cells. The vaccines undergo various inactivation steps, are highly purified, and then are adjuvant with aluminum phosphate or aluminum hydroxide and preserved with thimerosal (Mahoney, 1999).

2.17.4. Vaccine doses and administration

- The vaccine is usually administered as three dose series. The second dose should be given 1 month after the first dose; the
third should be given at least 2 months after the second dose and at least 4 months after the first dose.

- Alternatively, the vaccine ENGERIX-B is manufactured by Glaxo Smith Kline, is also approved for administration on four dose schedules at 0, 1, 2 and 12 months.

- There is also a two dose schedules for RECOMBNA HB, which has been licensed for children and adolescents 11 – 15 years of age. Using two schedules the adult dose of RECOMBIX HB is administered with second dose given 4 – 6 months after the first dose.

- TWINRIX, is a combined hepatitis A and hepatitis B vaccine licensed for person 18 years of age or older, primary immunization consist of three doses on 0, 1, and 6 months schedule.

- A three dose series that has been started with one brand of vaccine may be completed with other brand.

These vaccines, have been shown to be safe for person of all ages (Chaves, 2010).

The vaccine can be given as either three or four separate doses as a part of existing routine immunization schedules (WHO, 2011). If the
vaccination series are interrupted after the first dose, the second dose should be administered as soon as possible, the second and the third doses should be separated by an interval of at least 2 months. If administered when convenient (CDC, 2006).

In maternal–neonatal transmission of HBV, HB IG was given to newborn babies of infected mother with first dose HB vaccine.

HBV vaccination and one dose of HBIG administered with 24 hours after birth are 85 – 95% preventing both HBV infection and chronic carrier state. HB vaccine administered alone with 24 hours birth is 70 - 90 % effective in preventing perinatal HBV infection (WHO, 2010).

The HB vaccine should be offered to all individual at high risk from HBV infection.

2.17.5. Immunogenicity and efficacy of vaccines

The protective efficacy of hepatitis B vaccine is directly related to the development of anti-HBs after a primary vaccination series are virtually 100% protect against clinical illness and chronic infection.

The complete vaccine series induces protective antibody levels in more than 95% of infants, children and young adults. After age 40 years protection following primary vaccination series drops below 90%. At age
60 years old, protective antibody levels are achieved in only 65 – 75% of those vaccinated. Protection last at 20 years and should be lifelong. All children and adolescents younger than 18 years old and not previously vaccinated should receive the vaccine (WHO, 2011).

Females generally seroconvert more quickly than males, as well, anti-HBs titers are higher in females than in males after three doses of vaccine.

Although other host factors such as smoking – obesity – HIV infection and presence of chronic diseases contribute to decrease the immunogenicity of the primary vaccination series. Age is the major determinant of poor immune response (Mahoney, 1999).

2.17.6. General preventive measures

- Screening of blood, blood products donated tissue and organ, and this is an enforced policy in almost every country in the world.

- Strict adherence to standard microbiological practices and techniques.

- Routine use of appropriate barrier precautions to prevent skin and mucous membrane exposure when handling blood and other body's fluids at all patient levels in health care setting (SAVIC, 2009)
2.17.7. **Life style measures for HBV prevention**

The following precaution for preventing transmission of hepatitis B virus infection:

- Know the HBV status of any sexual partner.
- Use a new latex or polyurethane condom every time during sex.
- Stop using illicit drugs.
- Avoid sharing personal items such as razors or tooth brushes, syringes etc.
- Be cautious about body piercing and tattooing.
- Vaccination before travel to a region where hepatitis B is more common (MFMER, 2009).

2.18. **Prevention of HBV infection in healthcare workers**

Any healthcare worker should be vaccinated or have serologic evidence of immunity due to natural infection. Healthcare worker should be tested 1-2 months after completion of 3 dose vaccination series for antibody to hepatitis B surface antigen. Persons who do not respond to primary vaccine series should complete a second 3 dose vaccine series or
be evaluated to determine if they are HBsAg positive. Revaccinated persons should be tested at the completion of the second vaccine series (Gunson, 2003).
CHAPTER THREE

Methodology

3.1 Study design

This is a cross-sectional descriptive study carried out over a period of six months from December 2009 to May 2010, to study the epidemiology of hepatitis B infection among students of health sciences in the University of Gezira.

3.2 Study area

University of Gezira had been established according to the republican decree issued on November 1975. It is located in Wad Medani town, the capaital of Gezira State which lies in the middle of Sudan between latitude (30° - 15) – (32° - 13) N and longitude (20° - 34) (22° - 32) E. (Mohamed, 2005).

The mission of the university is; training of professional cadres in various fields of knowledge, introduction of modern technological method for promotion of health and preparation of scientific research to benefit from advanced technology

The educational process in the university started at 1978 with four faculties, but during the past 30 years there was a great development in the university, that there was an increase in the number of faculties to 21 faculties, 9 research institutes and 15 research centres and accordingly
there was an increase in the number of students and staff. These faculties are distributed in 7 localities in Gezira State.

In the university there is an administration of health services, that is responsible for providing health services all over the university through (13) health centres which are distributed in different faculties.

The mission of this administration is; provision of health services (therapeutic and preventive) for all students and staff, provision of health services at level of medical officers, lab-technician, pharmacists, and psychologists; pick up the special cases in the first medical examination and during study period and referring them to special units.

The staff of administration consist of a general director, an assistant of general director, medical director, administrative supervisor, statistician and secretary.

In the university there are six faculties for health sciences established for promotion of health and training of professional cadre in health fields. These faculties includes; medicine, dentistry, pharmacy, applied sciences, laboratory sciences and health & environmental sciences. (as illustrated):
<table>
<thead>
<tr>
<th>Faculty</th>
<th>No. of students</th>
<th>Year of establishment</th>
<th>Period of study</th>
<th>Location</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicine</td>
<td>1207</td>
<td>1975</td>
<td>5 years</td>
<td>Razi-medani</td>
</tr>
<tr>
<td>Dentistry</td>
<td>277</td>
<td>2001</td>
<td>5 years</td>
<td>“ “</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>387</td>
<td>1994</td>
<td>5 years</td>
<td>“ “</td>
</tr>
<tr>
<td>Applied Sciences</td>
<td>509</td>
<td>1997</td>
<td>4 years</td>
<td>“ “</td>
</tr>
<tr>
<td>Laboratory sciences</td>
<td>180</td>
<td>1998</td>
<td>4 years</td>
<td>“ “</td>
</tr>
<tr>
<td>Health &amp; Environmental Sc.</td>
<td>195</td>
<td>1994</td>
<td>4</td>
<td>Hosh town.</td>
</tr>
</tbody>
</table>

3.3 **Study population**

The total number of students of health sciences is 2755 students.

3.4 **Sampling techniques**

Stratified random sampling was used, that each faculty represents stratum and students in each faculty were selected randomly from different batches.

3.4.1 **Selection criteria**

All students registered at the time when the study was carried were included in the study.

3.4.2 **Inclusion criteria:**

Students in batch 28 to 32 in faculties of medicine, dentistry and pharmacy, and students in batch 29 – 32 in faculties of applied sciences
laboratory sciences and health and environmental sciences were included in the study.

### 3.4.3 Exclusion criteria

Students at the end of semester 10 in faculties of medicine, dentistry and pharmacy (27), and students at end of semester 8 in faculties of Applied sciences, laboratory sciences and health and environmental sciences (28) were excluded to avoid any loss in sample size because they were in final semesters.

### 3.4.4 Sample size

The sample size was about 649 students that represents (24%) of total study population.

The sample size was determined by using the following formula:

\[
\begin{align*}
n &= \frac{Z^2 \sum N_n^2 PQ/W}{N^2 d^2} \\
&\text{(Lemeshow et al, 2004)}
\end{align*}
\]

\(Z =\) is normal score according to normal distribution value at 95% level of confidence

\(N_n =\) Number of students in each faculty (stratum)

\(N =\) Total number of students

\(P =\) Stands for the prevalence of hepatitis B virus infection

\(Q =\) Is the proportion of normal persons.

\(W =\) Is the fraction of observations allocated to stratum equal \(N_n/N\)
\[ d = \text{is the difference between presents both in population and sample} \]

since the prevalence of hepatitis B virus infection is 12%. Thus \( P = 0.12, \ Q = 0.88, \ d = 0.025, \ Z = 1.96 \)

\[ n = \frac{Z^2 \sum N^2 PQ/W}{N^2 d^2} \]

\[ = \frac{(1.96)^2 (801873.529)}{(2755)^2 (0.025)} \]

\[ = \frac{3080477.349}{(7590025) (0.000625)} \]

\[ = \frac{3080477.349}{4743.765} \]

\[ \therefore n = 649 \] (total sample size).
Table: Show sample size in each faculty:

<table>
<thead>
<tr>
<th>Faculty</th>
<th>Total No of students</th>
<th>Sample size</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicine</td>
<td>1207</td>
<td>284</td>
<td>44</td>
</tr>
<tr>
<td>Dentistry</td>
<td>277</td>
<td>65</td>
<td>10</td>
</tr>
<tr>
<td>Pharmacy</td>
<td>387</td>
<td>91</td>
<td>14</td>
</tr>
<tr>
<td>Applied sciences</td>
<td>509</td>
<td>120</td>
<td>18</td>
</tr>
<tr>
<td>Laboratory</td>
<td>180</td>
<td>42</td>
<td>7</td>
</tr>
<tr>
<td>Health &amp; Environmental Sci.</td>
<td>195</td>
<td>47</td>
<td>7</td>
</tr>
<tr>
<td>Total</td>
<td>2755</td>
<td>649</td>
<td>100</td>
</tr>
</tbody>
</table>

3.5 Method of data collection

3.5.1 Questionnaire: Each student filled in structured questionnaire covering
- Basic information
- Information about knowledge
- Information about health. and risks to get infection with HBV and immunization.

3.5.2 Laboratory Diagnosis

Two laboratory tests were done by qualified laboratory technicians for diagnosis of hepatitis B infection among students of health sciences.

1- ICT:- Immuno Chromatographic Test.
A rapid one step test device (Kit) (InTec products, INC. China, 2009): was used for qualitative detection of hepatitis B surface antigen in serum.

- 5 ml of venous blood were drawn from each student and collected into anticoagulant EDTA tube.
- Labeled,
- Serum was separated from blood by centrifugation tube and preserved at -20°C until use.
- The specimens were brought to room temperature.
- Mixed well prior testing.
- Briefly the test strip was removed from the foil pouch and placed on clean dry surface.
- 3 drops of serum were transferred to specimen well of the device. The membrane is pre-coated with anti-HBsAg antibodies on the test line region.
- The serum specimen react with particle coated with anti HBsAg antibody and generate a colored line.
- After 15 minutes the result was read.

3.5.3 Interpretation of results

- Positive: two distinct red lines appeared. One line in the control region and another line in the test region.
Negative: one red line appeared in the control region.

2- ELISA:

The sera specimens that gave positive results in ICT were sent to the medical laboratory of Gezira Hospital for Renal Diseases and Surgery for more confirmation using ELSIA test kits (Marnes-la-Coquette-France -2009).

3.6 Data analysis and interpretation

The data initially recorded on the questionnaire forms were later analyzed with the aid of statistical expert using SPSS to provide data about the epidemiology of HBV infection. Chi–square test was used only to analyze results related to studied health sciences students. P <0.05 was considered statistically significant, but descriptive analysis of results related to HBsAg positive students was used because chi- square test will be unreliable to use when frequencies are less than 12.

3.7 Ethical consideration

The ethical approval was obtained from Gezira University ethical committee. Also a permission from deans of health sciences faculties and director of health services administration of University of Gezira was obtained. The principal investigator had a meeting with students and students association and explained the objective of the study. The participation was completely voluntary and students who were proved to
be positive to HBsAg were informed individually and confidentially and advised to seek health care.
Chapter Four

Results

A total of 649 students aged between 15-26 years were studied. They were classified according to age into age groups, (21.9%) in age group (15-18yrs), (65.2%) in age group (19 – 22yrs), (11.9%) in age group (23-26yrs) and(1.1%) in age group>26 years. as shown in figure (4-2-1-1).

The distribution of those students according to batch, (14%) in batch 28, (29%) in batch 29 , (30.5%) in batch 30, (3.1%) in batch 31 and (23.4%) in batch 32 as shown in figure (4-2-2-1).

Females were predominant (61.6%), while males were (38.4%) (p=0.005) as shown in figure (4-2-3-1).

The majority of students were Sudanese(96.8%) and only (3.2%) were foreigners as shown in figure (4-2-4-1).

The distribution of those students according to regions majority of them belonged to northern regions, (48.4%), followed by central regions (37.4%) as shown in figure (4-2-5-1).

With regard to families' residence of students, majority of them were found in central states(67.8%) as shown in figure (4-2-6-1).

(98.6%) of students were not married, while only (1.4%) were married as shown in figure (4-2-7-1).
4.1. Prevalence of hepatitis B virus infection among students

![Bar chart showing the prevalence of hepatitis B virus infection among students of health sciences faculties in (U of G)].

Figure (4-1-1): Showing the prevalence of hepatitis B virus infection among students of health sciences faculties in (U of G).

(7) (1.1%) of students were positive to HBsAg and (642) (98.9%) were negative.

Prevalence of HBsAg = 1.1%.
Figure (4-1-2): Showing the prevalence of hepatitis B infection among students of health sciences faculties in (U of G) within each faculty.

(4/284)(1.41%) of students positive to HBsAg were from faculty of medicine, (1/120)(0.83%) from medical applied sciences and (2/47)(4.80%) from Medical laboratory sciences.

( P = 0.000) (Significance difference between properties based on z approximation).
4-2. Personal data of students of health sciences (U of G).

![Bar chart showing age distribution among students of health sciences faculties in [U of G].](image)

Figure (4-2-1-1): Showing age distribution among students of health sciences faculties in [U of G].

(21.9%) of the students in age group (15-18) years, (65.2%) in age group (19-22), (11.9%) in age group (23-26) and (1.1%) in age more than 26 years (p=0.000).
Figure (4-2-1-2): Showing age distribution of students with positive HBsAg in health sciences faculties in (U of G).

(14.3%) of students in age group (15-18) years, (42.9%) in age group (19 – 22) years, and (42.9%) in age group of (23 – 26) years.
Figure (4-2-2-1): Showing batch distribution of students of health sciences faculties in (U of G).

(14%) of students from batch 28, (29%) from batch 29, (30.5%) from batch 30, (3.1%) from batch 31 and (23.4%) from batch 32. (p=0.000).
Figure (4-2-2-2): Showing batch distribution of students with positive HBsAg in health sciences faculties in (Uof G).

(42.8%) of students from batch 29, (28.6%) from batch 30 and also (28.6%) from batch 32.
Figure (4-2-3-1) : Showing sex distribution of students of health sciences faculties in (U of G).

(38.4%) of students were males and (67.6%) were females (p=0.005).
Figure (4-2-3-2): Showing sex distribution of students with positive HBsAg in health sciences faculties in (U of G).

(85.7%) of students were males and (14.3%) were females.
Figure (4-2-4-1): Showing nationality distribution of students of health sciences faculties in (U of G). (96.8%) of students were Sudanese and (3.2%) were Foreigners (p=0.04).
Figure (4-2-4-2): Showing nationality distribution of students with positive HBsAg in health sciences faculties in (U of G).

(85.7%) of students were Sudanese and (14.3%) were Foreigners.
Figure (4-2-5-1): Showing tribe distribution of students of health sciences faculties in (U of G).

(48.4%) of students belonged to Northern Sudan tribes, (37.4%) to Central Sudan tribes, (9.6%) to Western Sudan tribes, (1.2%) to Eastern Sudan tribes, (2%) to Southern Sudan tribes and (3.2%) were foreigners (p=0.000).
Figure (4-2-5-2): Showing tribe distribution of students with positive HBsAg in health sciences faculties in (U of G).

(42.8%) of students were belonged to central tribes(28.6%), belong to western tribes ,(14.3 %) were belonged to northern tribes,(14.3 %)were foreigners .
Figure (4-2-6-1): Showing family's residence of students of health sciences faculties in (U of G).

(2.3%) of students' families were resident in Northern States, (67.8%) in Central States, (2.5%) in Western States, (4%) in Eastern States, (15.7%) outside the country and (7.6%) in Khartoum State (p=0.000).
Figure (4-2-6-2): Showing family's residence of students with positive HBsAg in health sciences faculties in (U of G).

(71.4%) of students' families were resident in Gezira state, (14.3%) in White Nile state and (14.3%) outside the country.
Figure (4-2-7-1): Showing marital status of students of health sciences faculties in (U of G).

(1.4%) of students were married and (98.6%) of them were not married (p=0.338).
Figure (4-2-7-2): Showing marital status of students with positive HBsAg in health sciences faculties in (U of G).

(100%) of students were not married.
4-3. Students' knowledge about the disease (HBV infection).

Figure (4-3-1-1): Showing knowledge of students of health sciences faculties in [U of G] about hepatitis.

(90%) of students had knowledge about hepatitis and (10%) of them had no idea about hepatitis (p=0.007).
Figure (4-3-1-2): Showing Knowledge of students with positive HBsAg in health sciences faculties in (U of G ) about hepatitis.

(71.4%) of students had knowledge about hepatitis, and (28.6 %) had no idea about hepatitis.
Figure (4-3-2-1): Showing knowledge of types of hepatitis among students of health sciences faculties in (U of G) regarding hepatitis viruses.

(2.7%) know B&C, (12.7%) know A&B, (26.8%) know A,B&C, (16.6%) know A,B,C&D, (26.1%) know A,B,C,D&E, and (15.1%) don't know any (p=0.000).
Figure (4-3-2-2): Showing knowledge of types of hepatitis among students with positive HBsAg in health sciences faculties in (U of G) regarding hepatitis viruses.

(60%) of students had knowledge about types (A, B & C) and (40%) had knowledge about types (A, B, C, D, E).
Figure (4-3-3-1): Showing knowledge of students of health sciences faculties in (U of G) about the causative agent of hepatitis.

(82%) of the students had knowledge that the causative agent of hepatitis is a virus,(8%) of them said bacteria and (10%) of them don't know (p=0.001).
Figure (4-3-3-2): Showing knowledge of students with positive HBsAg in health sciences faculties in (U of G) about the causative agent of hepatitis B.

(71.4%) of students had knowledge about the causative agent of hepatitis B is the virus and (28.6%) had no idea about the causative agent.
Figure (4-3-4-1): Showing knowledge of students of health sciences faculties in [U of G] about the routes of transmission of hepatitis B.

(24.7%) of students said by blood & body' fluids, (1.7%) of them said by sexual intercourse , (1.7%) of them said by contaminated medical equipments, (15.1%) of them said through the placenta, (8.5%) said by blood, body' fluids & contaminated medical equipments, (6.7%) said by blood, body' fluids Sexual intercourse & contaminated medical equipments , (8%) said by blood, body' fluids. sexual intercourse & placenta, (9.2%) said by others (contaminated food and water, flies ), (27.9%) don't know (p=0.000).
Figure (4-3-4-2): Showing knowledge of students with positive HBsAg in health sciences faculties in (U of G) about the routes of transmission of hepatitis B.

(14.3%) of students said by blood and body fluids, the same percent said by blood and contaminated equipments, also the same percent said by blood and sexual intercourse, (57.1%) do not know.
Figure (4-3-5-1): Showing knowledge of students of health sciences faculties in [U of G] about the preventive measures potential of hepatitis B.

(88%) of students had knowledge that hepatitis B is a preventable disease, (6%) said it is not a preventable disease and (6%) of them don't know (p=0.000).
Figure (4-3-5-2): Showing knowledge of students with positive HBsAg in health sciences faculties in (U of G) about the preventive measures potential of hepatitis B.

(85.7%) of students had knowledge that hepatitis is preventable disease, (14.3%) do not know.
Figure (4-3-6-1): Showing knowledge of students of health sciences faculties in (U of G) about methods of prevention.

(60%) of students have knowledge that hepatitis B can be prevented by vaccine, (3.5%) by blood diagnosis, (1.9%) by protected sex, (2.3%) by sterilization, (17%) don't know, (10.2%) by others (sanitation, purification of water, food safety) and (4.4%) by blood diagnosis, protected sex & sterilization (p=0.000).
Figure (4-3-6-2): Showing Knowledge of students with positive HBsAg in health sciences faculties in (U of G) about methods of prevention of hepatitis B.:

(66.6%) of positive students had knowledge that hepatitis B can be prevented by vaccine, (16.7 %) do not know and the same percent said by others
4-4. Personal and family history of students of health sciences.

Figure (4-4-1-1): Showing past history of jaundice among students of health sciences faculties in [U of G].

(16%) of students have past history of jaundice, (74%) have no past history of jaundice and (10%) don't remember had past history of jaundice (p=0.004).
Figure (4-4-1-2): Showing past history of jaundice among students with positive HBsAg in health sciences faculties in (U of G).

(57.1%) of students had past history of jaundice and (42.9%) had no past history of jaundice.
Figure (4-4-2-1): Showing type of Past jaundice among students of health sciences faculties in [U of G]:

(3.1%) of them had hepatitis B & (96.9%) don't know. (p=0.124).
Figure (4-4-2-2): Showing type of past jaundice among students with positive HBsAg in health sciences faculties in (U of G).

(100%) of students do not know the type of their past jaundice.
Figure (4-4-3-1): Showing date of past jaundice among students of health sciences faculties in (Uof G).

(49%) of students have past jaundice during childhood, (8.3%) before 2-6 years ago and (42.7%) don't know (p=0.06).
(75%) of students had past history of jaundice since childhood and (25%) do not remember.
Figure (4-4-4-1): Showing past history of jaundice among wives or husbands of married students of health sciences faculties in [U of G].

(88.9%) of married students have no past history of jaundice among their wives or husbands and (11.1%) of them don't know (p=0.268).
Figure (4-4-5-1): Showing past history of Jaundice among family members of students of health sciences faculties in (U of G).

(5%) of students had past history of jaundice among their family members and (95%) of them had no past history among their family members (p=0.043).
Figure (4-4-5-2): Showing past history of jaundice among family members of students with positive HBsAg in health sciences faculties in (U of G).

(28.6%) of students had past history of jaundice among family' members and (71.4%) had no past history of jaundice among their family' members.
Figure (4-4-6-1): Showing family’ members of students of health sciences faculties in (U of G) who had past history of jaundice.

(15.1%) of family’ members who had past history of jaundice were mothers, (24.2%) fathers, (39.4%) brothers and (21.2%) sisters (p=0.530).
Figure (4-4-6-2): Showing family' members of students with positive HBsAg in health sciences faculties in (U of G) who had past history of jaundice.

(100%) of students who had past history of jaundice in family' members had jaundice among their mothers.
4-5. Risk factors

Figure (4-5-1-1): Showing past history of schistosomiasis among students of health sciences faculties in (U of G).

(3%) of students had past history of schistosomiasis, (88%) had no history of schistosomiasis and (9%) don't remember (p=0.2).
Figure (4-5-1-2): Showing past history of schistosomiasis among students with positive HBsAg in health sciences faculties in (U of G).

(100%) of students had no past history of schistosomiasis.
(4.8%) of students had past incidence of schistosomiasis since their childhood, (19%) before 2-5 years ago, (9.5%) before 6-9 years ago, (42.9%) before 10-13 years ago and (23.8%) don't know (p=0.020).
Figure (4-5-3-1): Showing past history of dental treatment among students of health sciences faculties in [U of G] .

(36%) of students had past history of dental treatment and (64%) of them had no past history of dental treatment (p=0.000)
Figure (4-5-3-2): Showing past history of dental treatment among students with positive HBsAg in health sciences faculties in (U of G).

(42.9%) of students had past history of dental treatment, (57.1%) of them had no history of dental treatment

- N.B. (14.3%) of those who had dental treatment, also had past history of jaundice among their mothers.
Figure (4-5-4-1): Showing date of dental treatment among students of health sciences faculties in (U of G).

(4.7%) of students of those who had dental treatment had been treated before less than a month, (2.1%) before 1-2 months ago, (29.1%) before 3-6 months ago, (54.3%) before more than 6 months, and (9.8%) don't remember (p=0.000).
Figure (4-5-4-2): Showing date of dental treatment among students with positive HBsAg in health sciences faculties in (U of G). (33.3%) of positive students had dental treatment before (3-6) months ago and (66.7%) had dental treatment before more than 6 months ago.
Figure (4-5-5-1): Showing past history of blood or blood products transfusion among students of health sciences faculties in [U of G].

(4%) of students had past history of blood or blood products transfusion and (96%) of them had no history of blood or blood products transfusion (p=0.581).
Figure (4-5-5-2): Showing past history of blood or blood products transfusion among students with positive HBsAg in health sciences faculties in (U of G).

(100%) of students had no past history of blood or blood products transfusion.
Figure (4-5-6-1): Showing date of blood or blood products transfusion among students of health sciences faculties in (U of G).

(3.8%) of students of those who had blood or blood products transfusion, had received blood before less than one month ago , (3.8%) before 1-2 months ago , (30%) before 3-6 months ago , (38.5%) before more than 6 months ago and (23.1%) don't remember (p=0.082).
Figure (4-5-7-1): Showing past history of surgical operation among students of health sciences faculties in [U of G].

(21%) of students had past history of surgical operation and (79%) of them had no history of surgical operation (p=0.657).
Figure (4-5-7-2): Showing past history of surgical operation among students with positive HBsAg in health sciences faculties in (U of G).

(100%) of students had no past history of surgical operation.
Figure (4-5-8-1): Showing date of surgical operation among students of health sciences faculties in (U of G).

(1.5%) of students of those who had past history of surgical operation had been done to them before less than one month ago, (4.5%) before 1-2 months, (19.4%) before 3-6 months, (69.4%) before more than 6 months and (5.2%) don’t remember (p=0.000).
Figure (4-5-9-1): Showing the illegal sexual practices among students of health sciences faculties in (Uof G).

(98.9%) of students had no illegal sexual practice and (1.1%) of them had illegal sexual practices. (p=0.093).
Figure (4-5-9-2): Showing the illegal sexual practices among students with positive HBsAg in health sciences faculties in (U of G).

(100%) of students had no illegal sexual practice.
Figure (4-5-10-1): Showing the use of condom by students of health sciences faculties in (U of G).

(29%) of students of those who had illegal sexual practices are using condom and (71%) of them are not using condom (p=0.344).
Figure (4-5-11-1): Showing past history of needle stick among students of health sciences faculties in [U of G].

(7%) of students had a history of needle stick, (52%) of them had no history of needle stick and (41%) of them don't remember (p=0.36).
Figure (4-5-11-2): Showing past history of needle stick among students with positive HBsAg in health sciences faculties in (U of G). (71.4%) of students had no history of needle stick and (28.6%) do not remember.
Figure (4-5-12-1): Showing practices of sharing personal items with others among students of health sciences faculties in (U of G).

(2%) of students had practices of sharing personal items with others and (98%) of them had no practices (p=0.042).
Figure (4-5-12-2): Showing practices of sharing personal items among students with positive HBsAg in health sciences faculties in (U of G).

(100%) of students had no practices of sharing personal items with others.
4-6. Prevention and immunization

![Pie chart showing immunization status against hepatitis B among students]

Figure (4-6-1-1): Showing immunization status against hepatitis B among students of health sciences faculties in [U of G].

(17%) of students were immunized, (72%) were not immunized and (11%) don't remember (p=0.000).
Figure (4-6-1-2) : Showing immunization status against hepatitis B among students with positive HBsAg in health sciences faculties in (U of G).

(100%) of students had not been immunized.
Figure (4-6-2-1): Showing number of doses of hepatitis B vaccine received by students of health sciences faculties in [U of G].

(15.7%) of immunized students received one dose, (18.3%) received two doses, (65.1%) received three doses and (0.9%) don't remember (p=0.067).
Figure (4-6-3-1) : Showing the time since the students of health sciences faculties in (U of G) had been immunized.

(25.7%) of immunized students had been immunized since childhood, (11%) before less than one year ago, (45.9%) before 1-2 years ago, (10.1%) don't remember and (7.3%) before more than 5 years ago (p=0.000).
Figure (4-6-4-1): Showing the supplier of hepatitis B vaccine of the students of health sciences faculties in [U of G].

(25.7%) were vaccinated by ministry of health, (45.9%) were vaccinated by students association, (17.4 %) were vaccinated outside the Sudan and (11%) don’t remembered (p=.000).
Figure (4-6-5-1): Showing knowledge of students of health sciences about groups at high risk of hepatitis B virus that vaccination is mandatory to them.

(35.9%) of students said health care workers, (6.5%) said youth, (7.1%) said children, (0.3%) said pregnant women, (1.4%) said youth and children, (1.7%) said children and pregnant women, (4%) said others (all population, old ages) and (43.1%) of them don’t know (p=0.000).
Figure (4-6-5-2) : Showing knowledge of students with positive HBsAg about the groups at high risk of hepatitis B that vaccination is mandatory to them.

(42.9%%) of students had knowledge that health care workers are at high risk of HBV infection, (42.9%) had no idea about the groups at high risk of HBV infection and (14.3%) said children.
Figure (4-6-6-1): Showing students' knowledge about number of doses of hepatitis B vaccine.

(1.2%) of students knew that the number of vaccine doses is one dose, (0.8%) said two doses, (51.6%) said three doses and (46.4%) don't know (p=0.000)
Figure (4-6-6-2): Showing knowledge of students with positive HBsAg about number of doses of hepatitis B vaccine.

(57.1%) of students had knowledge that the number of vaccine doses were three and (42.9%) had no idea.
Figure (4-6-7-1): Showing the students' knowledge about the earliest age for vaccination against hepatitis B virus.

(12.6%) of students said no definite age for vaccination against hepatitis B, (4.3%) said from birth to less than one year, (2.6%) from 1-5 years, (2.6%) more than 5 years and (77.9%) do not know (p=0.000).
Figure (4-6-7-2): Showing knowledge of students with positive HBsAg about the earliest age for vaccination against hepatitis B virus.

(28.5%) of students said that no definite age for vaccination against HBV, (14.3%) said that the earliest age is > 5 years, and (57.1%) do not know the earliest age for vaccination against hepatitis B virus.
Chapter Five

5-1. Discussion

Hepatitis B is a major worldwide health problem that cause a considerable morbidity and mortality in human population both from acute and chronic infection.

This study showed that, the overall prevalence rate of HBsAg among students of health sciences faculties in University of Gezira (Sudan) was (1.1%) and the prevalence rates of HBsAg within each faculties were, (2 out of 47)(4.8%) in medical laboratory,(4out of 284) (1.4%) in medicine,(1out of 120) (0.83%) in applied sciences and (0%) in pharmacy. health and environmental sciences and dentistry. These results were slightly low when compared with the global prevalence of HBsAg that, about one third of the world population are carriers of HBV. The proportion ranging from a maximum of (15-20%) in Africa (WHO, 2011) to (0.1 - 2%) in United states, Europe, Japan (CDC, 2008). Also this result was low when compared with the findings obtained by (Kirre, 1996) who found the carrier rate of HBV in sub-Saharan Africa ranged from 9 – 20 %.

This result was low when compared with results obtained by (Olubnuyide, 1997), in Nigeria, who found HBsAg carrier rate was 39% among doctors and dentists and (Lule, et al., 1989) who found that HBsAg HBsAg carrier rate of (18%) among medical students in Kenyatta National Hospital.

Also these results were low when compared with result obtained by (Pido and Kagimu, 2005), who found that the prevalence of HBsAg was 11% among the medical students of Makerere University in Uganda. %.
this result was low when compared with result obtained by (Mudawi, 2008) that prevalence of HBsAg in Sudan ranged from 6 -8% in central Sudan to 26% in Southern Sudan.

This result was low when compared with findings obtained by (Yousif, 2010) who found the prevalence of HBsAg among health care workers in Wad Medani Hospital was (4.2%).

The study revealed that, the age distribution among students of health sciences range was 15 – 26 years, with the majority of them in the age group of (19-22) years. Most of students positive to HBsAg (85.7%) were in age group of (19 – 22) years. This means that all students were adolescents and youth and they had many practices such as sharing personal items and playing sports that may increase the risk of exposure to the infection.

This is in agreement with the result reported by the American College Health Association (ACHA, 2001) that the highest rate of disease occured in individuals between ages of 20 – 49 years, living in close quarters like college dormitory may increase the risks of exposure carriers.

These result is in consistent with finding obtained by National Public Health Services of Wales (NPHS, 2009) that found (75%) of cases of HBV infection in England were individual between ages (15 – 44) years.

Another study conducted by (Middenen, et al., 2001) who found that (63%) of acute cases of HBV infection in United states occured in those between ages (15 – 29) years.
The age at acquisition of hepatitis B infection influences the risk of chronicity. Furthermore, the age at infection has an impact on the natural history of the disease.(O'shea, 2011)

The study found that, majority of studied health sciences students (73.5%) were in batches (28, 29, 30) and (26.5%) were in batches (31, 32). Also most of positive students (71.4%) from batches (28 29,30), while (28.6%) of them from batches (31,32). This result may indicate that, HBV infection was more prevalent in students from batch (28,29,30) because those students in final semesters are at high risk of exposure to HBV infection than students in batch (31,32), especially medical students, medical laboratory students and medical applied sciences students. Risk factors associated with HBV infection in clinical students include, accidental needle stick injuries and unprotected exposure to patient fluids.

These results are in agreement with the findings obtained by (Pido and Kagimu, 2005) who found that, clinical students were more likely to have been exposed to HBV, where (79.6%) of medical students testing positive for anti-HBc compared to (45.9%) among pre clinical students in Makerere university in Uganda.

With regard to sex distribution the study showed that, females were predominant than males, (61.6%) and (38.4%) respectively, but males were more affected by HBV infection than females (85.7) and (14.3%) respectively, with a male to female ratio of 6:1.

This result is in consistent with results obtained by (Abdo El karim, et al., 1989) who found that prevalence of HBV infection in rural black adults in south Africa was (7.1%) in men and (4.4%) in women.
Also another study conducted by (Abdo Elkarim, 1989), revealed that, prevalence of HBV is (14.6%) in men and (4.6%) in women in Kangwae.

Also the result is in agreement with the result reported by (NPHS of Wales, 2011), in United States, cases of HBV infection in males exceeded those in females and the annual male to female ratio was 2.4:1.

Also this result was the same when compared with finding reported by (CDC, 2003) in Canada, the annual male to female ratio of HBV infection was 2:1.

These results were in consistent with the fact reported by (WHO, 2011) that, males are more likely to remain persistently infected than females who are more likely to be infected transiently and to develop anti-HBs.

But this result is different from the study done by (Choi, et al., 2003) in Korea who found that, the prevalence of HBV infection among health care workers was more in female (79.5%) than males (21.5%).

Also this result is different from the findings obtained by (Yousif, 2010) who found that, the prevalence of HBV infection among health care workers in Wad Medani Hospital was more in females (57.9%) than males (42.1%).

The descriptive analysis of nationality of students of health sciences revealed that, (96.8%) of students were Sudanese while only (3.2%) were foreigners and (85.7%) of positive students were Sudanese. Although the study showed low prevalence of HBV among the students (1.1%) when compared with the result obtained from (central blood
bank, 2008) that the prevalence HBV infection in Sudan was in the range of 8 -12 %.

This result is different from findings obtained by (Mudawi, 2008) who reported that, Sudan is classified among countries with high HBV seroprevalence. Exposure to the virus varied from 44 – 78% .

This result is in consistent with previous study conducted by (Qribi, and Hall, 2001) who found, the prevalence of HBsAg in Sudan was in the range of 16 – 20%.

Regarding the tribe distribution of students of health sciences the study showed that majority of them belonged to northern tribes and central tribes (48.4%) and (37.3%) respectively . Also the study showed that (42.8%) of positive students belonged to central tribes followed by western tribes ((28.6%) followed by northern tribes (14.3%) and (14.3%) were foreigners.

These variations may be attributed to ethnicity and genetic predisposition among different tribes or it may be due to socio-economic differences between students.

The findings revealed that, the family's residence of majority of students of health sciences (67.8%) were in central states followed by outside Sudan (15.7%) .Also (71.4%) of positive students were resident in Gezira state, (14.3%) were in White Nile and (14.3%) out side the sudan.

This result reflected that, the majority of positive students are living in Gezira state, but the prevalence of HBV infection among students was low when compared with the findings obtained from ( Wademani blood bank, 2007) that the prevalence of HBV infection in Gizera state was 12% . Also this result is different from previous study done by
(Hyam et al., 1989) in El-Gezira rural area where the prevalence of HBsAg was 18.7%. Also this finding is different from the result obtained by (El Shafie, 1992) who found the prevalence of HBsAg among blood donors and laboratory technical staff from Gezira state to be (17.3%) and (12.1%) respectively.

Also this result is not in agreement with the result obtained by (Kaizer, et al., 1989) who found HBsAg in (20.7%) of patients in Wad Medani teaching hospital. Also this result is different from the finding obtained by (Mohammed, 1996) who found that, the prevalence of HBsAg was (10%) in patients in Wad Medani Teaching Hospital.

With regard to marital status of health sciences students majority of them (98.6%) were single and only (1.4%) were married. Also the study explained that, (100%) of positive students were single.

These results indicated that, the majority of health sciences students were single and live in closed barracks may be at high risk of contracting or transmitting the disease, because marriage is the one of protective measures against sexual transmitting diseases, although hepatitis B virus infection, and this result is in agreement with American College Health association (ACHA, 2001) that reported, health sciences students who live in college barracks at high risk of HBV infection because they may have sexual practices.

The study revealed that, most of health sciences students (89.8) heard about hepatitis and (10.2%) of them had no idea about it, among positive students (71.4%) of them heard about hepatitis and (28.6%) of them had no idea about hepatitis. This is a good indicator that majority of students heard about hepatitis.
With regard to knowledge about types of hepatitis, only (26.1%) of health sciences students had knowledge about all types of hepatitis. Also only (40%) of positive students had knowledge about all types of hepatitis. This reflects that health sciences students had no enough knowledge about all types of hepatitis, in spite of the fact that (73.5%) of them were in final years (Batches 28, 29, 30), this is due to the fact that students of some faculties like pharmacy and health & environmental sciences had a little knowledge about types of hepatitis so that students should be aware about all types of hepatitis from the first semester.

The findings showed that, most of health sciences students (88.9%) had knowledge about the causative agent of hepatitis B and (71.4%) of positive students had the same knowledge that hepatitis B is the viral disease, and this a good indicator that the students had a good knowledge about the causative agent of hepatitis B.

Most of health sciences students, (72.9%) had knowledge about routes of transmission of HBV, but about (57.1%) of positive students had no knowledge about the routes of transmission. This may be the reason behind their infection and this is in agreement with (ACHA, 2001) that reported, health sciences students may be exposed to blood or body's fluids or tissues from patients with hepatitis B infection in addition while in college, student may travel aboard to areas where the disease is common, during sport in which players may be exposed to each other's blood or saliva, through sharing personnel items and through sexual contact.

The majority of health sciences students had knowledge that hepatitis is a preventable disease (88%). And (72.8%) of them had knowledge about methods of prevention. Also (85.7%) of positive students had knowledge
that hepatitis is a preventable and (66.6%) had knowledge about methods of prevention.

These results reflected that students had a good knowledge about the prevention of hepatitis B and methods of prevention and this in agreement with (Simon and Zieve, 2008) who mentioned that, hepatitis B is a vaccine preventable disease, the vaccine is effective in preventing HBV infection when it is given either before exposure or shortly after it.

The findings showed that (16%) of health sciences students had past history of jaundice and (96.9%) of them did not know the type of their disease and (49%) acquired the infection during childhood and (42.7%) did not remember the date of their disease. With regard to positive students, (57.1%) of them had past history of jaundice, all of them (100%) did not know the type of their disease and (75%) of them acquired the infection during childhood. These results indicate that, the students who acquired the hepatitis B virus infection during childhood will become persistent chronic carriers and this is in agreement with (WHO, 2011) that reported, up to 90% of infected young children will fail to clear the virus from their bodies and go to develop chronic infection.

With regard to the past history of jaundice among wives or husbands, the study explained that (88.9%) of married health sciences students had no past history of jaundice among their wives or husbands, but (100%) of positive students were single this means that transmission of HBV through sexual contact with marital life is not associated with the occurrence of HBV infection among students.

The study showed that (6.1%) of health sciences students had past history of jaundice among their family members, (15.2%) of them among
mothers, (24.2%) among fathers, (39.4%) among brothers and (21.2%) among sisters.

Among positive students, (28.6%) had past history of jaundice among their family members, (100%) of them had jaundice among their mothers and (100%) of them do not know the type of jaundice among their mothers. This indicates that HBV infection is likely to be transmitted between family members.

Those positive students may acquire the infection from their mothers either vertically or horizontally and this is in agreement with (Lin, 2004) who mentioned that an infected mother can transmit the virus to the baby during delivery or shortly thereafter.

Eighty seven percent of health sciences students had no past history of schistosomiasis, only (3.2%) of them had past schistosomiasis, (42.5%) were infected with schistosomiasis before 10 – 13 years ago. Among positive students (100%) there is no past history of schistosomiasis. This result reflects that there is no association between schistosomiasis and occurrence of HBV infection among health sciences students and this result is different from the result obtained by (Berho, et al, 2008) who found the prevalence of HBsAg was 3.5% in patients with schistosoma mansoni.

Regarding dental treatment (36.2%) of health sciences students had past history of dental treatment. (54.3%) had dental treatment before more than six months and (29.1%) 3 – 6 months. Among positive students (42.9%) had past history of dental treatment with (14.3%) of whom had past history of jaundice among family's member (mother). Thirty three percent of positive students had past history of dental
treatment before 3 – 6 months ago while (66.7%) had dental treatment before more than six months ago. This result reflects that there is an association between dental treatment and occurrence of HBV infection among students.

The study revealed that (4%) of health sciences students had past history of blood transmission. (38.5%) of them had received blood before more than six months, followed by (30.8%) received blood before 3 – 6 months. Among positive students (100%) of them had no past history of blood transfusion. These results indicate that blood transfusions as a risk factor for HBV infection is not associated with the occurrence of HBV infection among students and also means that, the national blood transfusion services, polices, infrastructure and trained personnel are adequate and this is in agreement with (Ndumbe and Nyouma, 1990) who reported the safety of blood and blood products is the one of the major factor in the area of transfusion medicine. Transmission of HBV through donated blood is reportedly very common in developing countries including sub-Saharan Africa ranges between 3 – 22% in blood donors. Also this finding is in agreement with WHO, (2011) that reported, in the past, recipients of blood and blood products were at high risk for HBV infection. Over the last 25 years, testing blood donations for HBsAg has become a universal requirement. Testing procedure have made major progress in sensitivity in the last 15 – 25 years. However 10% of countries reported that they were not testing all blood donation for HBsAg. In many countries, where pre-transfusion screening of blood donation for HBsAg is carried out systematically, the residual risk of HBV transmission is minimal. Moreover, plasma derived medicinal products (including antihaemophilic factors) undergo additional viral inactivation and removal
procedures resulting in greatly reduced or no transmission of HBV by these products.

Regarding surgical treatment (20.6%) of health sciences students had past history of surgery, this high percent may imply ear piercing and circumcision, the majority of them (69.4%) had history of surgery before 6 month ago. (100%) of positive health students had no past history of surgery. This reflects that all students who had past history of surgery did not develop HBV infection and this means that there is a high quality of sterilization process in operational rooms since HBV can be transmitted by unsterilized medical equipment as mentioned by (Mcmahon, et al., 1985).

Also this result indicates that past history of surgery as a risk factor is not associated with occurrence of HBV infection among students in this study.

This study showed that only (1.1%) of health sciences students had illegal sexual practices, although the students denied the illegal sexual practices for socio-cultural reasons. (71.4%) of them did not use condom during sexual practices.

This result indicated that those students are at high risk of HBV infection through sexual exposure because they are in young ages and live in college barracks may be sexually active and this is in agreement with (Corona, 1991), that sexual exposure is a risk for heterosexual and homosexual transmission of hepatitis B. (NPHS of Wales, 2009) reported, heterosexual exposure account for (28%) of acute hepatitis B virus infection and homosexual exposure account for (17%) of acute hepatitis B. Also the result showed that the majority of students who had illegal
sexual practices did not use condom and this indicates that students at high risk of HBV infection. So that it is very important to use condom during sex and this is in agreement with Mayo Foundation for Medical Education and Researches (MEMER, 2009) that reported, to avoid HBV infection use of a new latex or condom every time during sex.

Findings showed that (100%) of positive health sciences students had no illegal sexual practices this indicates that illegal sexual practices as a risk factor is not associated with the occurrence of the disease among those students.

The findings revealed that only (7.2%) of students had history of parenteral injections and no one of positive student (0%) had past history of parenteral injections. Also the study revealed that (2.3%) of health sciences students had practices of sharing personal items and no one of positive students had these practices. These results indicated that needles stick and sharing of personnel items as risk factors of HBV infection were not associated the prevalence of the disease among students in this study. Although health sciences students may denied the practice of sharing personal items and may be not aware enough about the seriousness of sharing personal items as a risk factor associated with infection as mentioned by Viral Hepatitis Prevention Board and (VHPB, 1998) that the risk is still present in many developing countries, contaminated and inadequately sterilized syringes and needles have resulted in out breaks of hepatitis B among patients in clinics and physicians offices.

This study showed that (72.1%) of health sciences students were not immunized against HBV while (100%) of positive students were not immunized. This result shows low rate of immunization among health
sciences students which put them at high risk of developing HBV infection and this is in agreement with (ACHA, 2001) that reported, health sciences students should be immunized against HBV infection.

Also this result is in agreement with the result obtained by (Pido Khagemu, 2005) who found that medical students in Uganda have low immunization rate.

The findings showed that (65.1%) of the immunized health sciences students received three doses of vaccine, (18.3%) of them received two doses and (15.6%) received one dose. This result indicates that, those who had incomplete number of vaccine doses will develop low level of immune response and may be at risk of developing HBV infection and this is in agreement with (Simon and Zieve, 2008) who reported that,(40% )of adolescents who receive one dose of vaccine as newborns had declining immunity to the disease by age 14 years. Also (WHO, 2009) reported that, the complete vaccine series induce protective antibody levels in more than 95% of infants, children and young adults.

This study revealed that (25.7%) of immunized health students were immunized during their childhood while(74.3%) were immunized before 1 – 5 years ago . This indicates that the majority of students were immunized when they were adolescents after their administration to university so that, the students may be exposed HBV before immunization also the age is the major determinant factor of poor immune response to vaccine and the protection following primary vaccination series will drop as the age increased as reported by (WHO,2011), that, protection following primary vaccination series drops as the age increased .
With regard to the supplier of hepatitis B vaccine, (45.9%) of health sciences students were vaccinated by students association. This result indicates that students association play an important role in vaccination of students against HBV infection while only (25.7%) of them vaccinated by ministry of health because vaccination against HBV was included as a part of Expanded Program of Immunization (EPI) in Sudan in 2005. as reported by (Mudawi, et al., 2007).

The findings showed that (43.1%) of health sciences students had no knowledge about groups at high risk of HBV and that vaccination is mandatory to them, followed by (35.9%) had knowledge that health care workers at high risk of HBV and to be vaccinated.

Among positive students (42.9%) had no idea about groups at high risk of HBV and whom the vaccination is mandatory to them. These results reflect, that students had no enough knowledge about the groups at highest risk as reported by (NPHS, 2009) that, the vaccine should be offered to all healthcare workers who include, cleaners, nurses, doctors, dentists, laboratory workers and health safety workers and this is supported by (Magolis and Presson, 1993) who mentioned that, vaccination of healthcare workers has been recommended by Immunization Practices Advisory Committee of US Public Health Service.

Following licensure of hepatitis B vaccine late in 1981, programs to vaccinate healthcare workers were found primarily in large hospitals. However, in 1985 it was estimated that fewer than 25% of healthcare workers had been vaccinated. In 1991, the Occupational Safety and Health Administration (OSHA) issued regulations to ensure protection of health care workers from the hazard of infection with blood borne pathogens.
With regard to the number of vaccine doses (51.1%) of students had knowledge that hepatitis vaccine is series of three doses, followed by (46.4 %) do not know the number of vaccine doses .Among students positive to HBsAg (57.1%) had knowledge about the number of doses while (42.9%) do not know the actual number of vaccine doses .

This means that health sciences students had no enough knowledge about the actual number of vaccine doses as mentioned by (CDC, 2008), that immunization against HBV is given as series of three shots over a 6 months period.

The findings showed that (77.8%) of health sciences students had no idea about the earliest age for vaccination and only (4.3%) of them had knowledge that the earliest age for vaccination is at birth, also the study showed that,(57.1%) Of students positive to HBsAg had knowledge about the earliest age is at birth, followed by (28.6%) who said there is no definite age and (14.3%) who said more than five years is the earliest age. These results reflect the poor knowledge of health sciences students about the earliest age for vaccination against HBV, that all infants should receive the HB vaccine sooner after birth as mentioned by( Simon and Zieve, 2009).

Health sciences students need to be offered more information and support regarding prevention of HBV including vaccination and use of universal precautions for infection control.
5.2 Conclusion and Recommendations

5.2.1 Conclusion

649 students of health sciences faculties in University of Gezira were screened for HB sAg using ICT and positive results were confirmed by ELISA.

- Low prevalence of hepatitis B virus infection among students of health sciences (7 out of 649)(1.1%).
- The prevalence of HBV within faculties, was high in faculty of medical laboratory sciences, (2 out of 47)(4.8%), followed by faculty of medicine (4 out of 284)(1.4%) followed by medical applied sciences (1 out of 120)(0.83%) and it was zero in faculties of pharmacy, health and environmental sciences and dentistry.
- Males were more affected by HBV infection than females, (85.7%) and (14.3%) respectively with a male to female ratio 6:1.
- (71.4%) of positive students were from Gezira state.
- (7%) of health sciences students had past history of needle stick.
- Past history of jaundice among students positive for HBV was in (57.1%).
- The major risk factors associated with the infection in students are; infected mother(28.6%), dental treatment (28.6%) ,both infected mother and dental treatment(14.3%) while in (28.5%) of students positive to HBsAg the source of their infection was unknown.
- Low level of awareness towards routes of transmission, high risk groups, number of vaccine doses and the earliest age of vaccination.
- There was no association between schistosomiasis and HBV infection among students.
- The students had no enough knowledge about hepatitis B virus infection although those at final years.
- Low rate of immunization (17%) among all studied students and (0%) among students positive to HBV infection.
5.2.2. Recommendations

5.2.2.1. Recommendations for Administration of Health Services in University of Gezira:

- Screening of all students of health sciences for HBsAg and vaccination of those negative to HBsAg.
- provision of medical care for those positive HBsAg.
- Routine follow-up of students who are chronic carriers.
- Early provision of health education for students at first registration.
- Encouragement and support of health sciences students to take all precautions necessary to prevent and control of HBV infection especially before beginning clinical rotation.

5.2.2.2. Recommendations for Ministry of Health:

- Improvement of maternal and child health care and screening of pregnant women at first visit to medical care to prevent perinatal transmission of HBV
- provision of appropriate treatment.
- Provision of post exposure prophylaxis of adults involves HBIG.
- Screening and vaccination of health care workers
- Improvement of HBV control measures to prevent nosocomial spread of the disease in hospital.
- Importance of conducting comprehensive survey in Gezira state for screening HBsAg for detection of chronic carriers and control of infection
- Public health education about HBV infection especially health care workers.
- Health education of students who are joining to the University of Gezira about hepatitis B virus infection at first registration.
- Integration of HBV control with HIV control program since they have the same modes of transmission.
- Catch-up vaccination of adolescents through Expanded Program of Immunization (EPI) ..
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APPENDIX (A)

بسم الله الرحمن الرحيم
جامعة الجزيرة
كلية العلوم الصحية و البيئية
استبيان لدراسة وبائية التهاب الكبد (ب) وسط طلاب كليات العلوم الصحية بجامعة الجزيرة

المعلومات الأساسية:

الرقم المسلسل:
العمر:
الكلية:
الدفعة:
النوع: ذكر ( ) اثني ( )
الجنسية:
القبيلة:
سكن الأسرة:

الحالة الاجتماعية: متزوج ( ) غير متزوج ( ) مطلق ( ) ارمل ( )
هل سعت عن التهاب الكبد (ب)؟ نعم ( ) لا ( )

لماذا كانت الإجابة بنعم ما هي انواعه؟
ما هو العامل المسبب لالتهاب الكبد (ب)?
فيروس ( ) بكتريا ( ) طفل ( ) اخرى ( )
كيف ينتشر التهاب الكبد (ب)?

هل هو مرض يمكن الوقاية منه؟ نعم ( ) لا ( )

لماذا كانت الإجابة بنعم كيف؟
هل حصل اصيبي باليقان؟ نعم ( ) لا ( ) لا اتذكر ( )

لماذا كانت الإجابة بنعم ما نوعه؟
متى كانت الإصابة؟
لقد كنت متزوجة هل اصيبت زوجتك او اصيبت زوجك بالبرقان؟

نعم ( ) لا ( ) لا اتذكر ( )

هل كانت الإجابة بنعم ما نوعه؟ ( ) ( ) ( ) ( ) لا اتذكر ( )

هل كانت الإصابة؟

هل اصيب أحد أفراد أسرتك بالتهاب الكبد (ب)؟ نعم ( ) لا ( ) لا اتذكر ( )

هل كانت الإجابة بنعم من هو؟

الاب ( ) اخ ( ) اخت ( )

هل حدثت لك اصابة بالبليهارسيا في الماضي؟

نعم ( ) لا ( ) لا اتذكر ( )

هل كانت الإجابة بنعم متى كان ذلك؟

هل تلقيت علاج بعيادات الاسنان؟ نعم ( ) لا ( ) لا اتذكر ( )

هل اجري ذلك نقل دم أو مشتقاته؟ نعم ( ) لا ( ) لا اتذكر ( )

هل كانت الإجابة بنعم متى كان ذلك؟

هل اجريت تلك عملية جراحية؟ نعم ( ) لا ( ) لا اتذكر ( )

هل كانت الإجابة بنعم متى كان ذلك؟

هل لديك ممارسات جنسيه خارج اطار الشرع؟ نعم ( ) لا ( ) لا اتذكر ( )

هل كانت الإجابة بنعم هل تستعمل عاذل ؟ نعم ( ) لا ( ) لا اتذكر ( )

هل طعنك ابهر ملوثه في الماضي؟ نعم ( ) لا ( ) لا اتذكر ( )

هل تبادلتم مواس حلافة أو مقالم اظهار مع الآخرين ؟ نعم ( ) لا ( ) لا اتذكر ( )

هل انت مطعوم ضد التهاب الكبد (ب)؟ نعم ( ) لا ( ) لا اتذكر ( )

هل كانت الإجابة بنعم ما هي عدد الجرعات التي اخذتها؟

واحدة ( ) ثلاث جرعات ( )

هل كانت مطعوم متى كان ذلك؟

ما هي الجهة التي قامت بتطعيمك؟

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ماهي الفئات الأكثر عرضة للأصابة بالتهاب الكبد (ب) والذي يجب نطعيمهم إجباريا؟

كم عدد الجرعات اللازمة للوقاية من التهاب الكبد (ب)؟

ماهو العمر المحدد للتطعيم ضد التهاب الكبد (ب)؟

نتيجة التحليل:

ICT :-  1. +ve    2. -ve
ELISA: 1. +ve    2. -ve