Al-Razi University
Graduate Studies
College of Medical Sciences
Community Health & Nutrition Department

Sero-prevalence and Associated Factors of Viral Hepatitis B and C infection among Pregnant Women in Alaeen Valley, Hadhramout Governorate, Yemen

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Thesis Submitted to the Community Health & Nutrition Department College of Medical Sciences, AL-Razi University as Partial Fulfillment for MSc. in Epidemiology

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جـامـــعـة الرازي
الدراسات العليا
كلية العلوم الطبية
قسم صحة المجتمع والتغذية

الإنتشار المصلي والعوامل المرتبطة بعدوى إلتهاب الكبد الفيروسي البائي والسيني بين النساء الحوامل في وادي العين محافظة حضرموت-اليمن

رسالة مقدمة إلى قسم صحة المجتمع والتغذية، كلية العلوم الطبية، جامعة الرازي لإستكمال متطلبات نيل درجة الماجستير في الوبائيات

الباحث

احمد عبد الله نصيب بن بركات

بكالوريوس في المختبرات الطبية

المشرف الرئيس

الدكتور: عبد الله عبد العزيز محرم

أستاذ طب المجتمع المشارك
كلية الطب والعلوم الصحية
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أنه في يوم الاثنين الموافق 2020/10/19 تم اجتماع لجنة المناقشة والحكم على رسالة الماجستير المقدمة من الطالب/ **احمد عبدالله نصيب احمد بن بركات** المسجل بكلية العلوم الطبية تخصص **وبائيات** والمشكلة بقرار مجلس الدراسات العليا والبحث العلمي في محضر اجتماع رقم (09) بتاريخ 2020/09/30 بتشكيل لجنة المناقشة والحكم من الدكاترة التالية:

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(Seroprvalance and associated factors of viral hepatitis B and C infection among Pregnant women in Alaeen Valley, Hadhramout Governorate, Yemen).

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CERTIFICATE

This is to certify that the thesis entitled ***Sero-prevalence and Associated Factors of Viral Hepatitis B and C infection among Pregnant Women in Aleen Valley, Hadhramout Governorate. Yemen;*** is Submitted to Community Health & Nutrition Department, College of Medical Sciences, AL-Razi University for the award master's degree in ***Epidemiology***. It is a record of the original and confides research work carried out by ***Ahmed Abdullah Naseeb Bin Barkat*** under our supervision. Such material as has been obtained from other sources has been duly acknowledged in the thesis. This thesis embodies the work of the candidate himself and no part thereof has been submitted for any other degree.

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Dedication

This thesis is dedicated to

My great parents, who never stop giving of themselves in countless ways,

My dearest wife, who leads me through the valley of darkness with the light of hope and support,

My beloved brothers and sister,

My beloved kids: Abdullah, Fatima, Barkat & Abdul Malik whom I cannot force myself to stop loving. To all my family, the symbol of love and giving,

My friends who encourage and support me,

All the people in my life who touch my heart.

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LIST OF ABBREVIATION

µl	Micron
AASLD	American Association for the Study of Liver Disease
Abs	Antibodies’
ACG	American College of Gastroenterology
Ags	Antigens
AHB	Acute Hepatitis B
ALP	Alkaline Phosphatase
ALT	Alanine Aminotransferase
AST	Aspartate Aminotransferase
CDC	Center for Disease Control and Prevention
CHB	Chronic Hepatitis B
CKD	Chronic Kidney Disease
CLD	Chronic Liver Disease
Cm	Centimeter
DDAs	Direct Acting Antivirals
DNA	DNA Deoxyribonucleic Acid
EHMs	Extrahepatic Manifestations
EIA	Enzyme Immuno Assay
ELISA	Enzyme-linked Immunosorbent Assay
F	Frequency
FDA-approved	Food and Drug Administration approved
HbcAg	Hepatitis B Core Antigen
HbeAg	Hepatitis B Early Antigen
HBeAg+	Hepatitis B Early Antigen Positive
HBIG	Hepatitis B Immunoglobulin
HbsAg	Hepatitis B Surface Antigen
HBsAg+	Hepatitis Surface Antigen Positive
HBV	Hepatitis B Virus
HCV	Hepatitis C Virus
HIV	Human Immunity Virus

HVR1	Hypervariable Region 1
IgG	Immunoglobulin G
IgM	Immunoglobulin M
IL	Interleukin
IRES	Internal Ribosome Entry Site
IU/ml	International Units per Milliliter
Iv	Intravenous Injection
Km^2	Kilometer Secure
LFTs	Liver Function Tests
m RNA	Messenger Ribonucleic Acid
Ml	Milliliter
MTCT	Mother to Chilled Transmission
Nm	Nanometer
N	Number
NS	Nonstructural
PCR	Polymerase Chain Reaction
RIA	Radio Immunoassay
RNA	Ribonucleic Acid
SD	SD Standard Deviation
SPSS	Statistical Package for the Social Science
TMA	Transcription Mediated Amplification
TMB	Tetra Methyl Benzidine
TSB	Total Serum Bilirubin
USA	United State America
UTR	Untranslated Region
WHO	World Health Organization

ABSTRACT

Background of the study

Viral hepatitis is a public health problem and challenge globally. Viral hepatitis B &C infection during pregnancy is associated with a high risk of maternal complications including pre-eclampsia, placenta praevia, preterm delivery, placental separation, antepartum hemorrhage, preterm labor, increased incidence of intraventricular hemorrhage, gestational diabetes mellitus, and mortality with a high rate of vertical transmission leading to fetal and neonatal hepatitis. This study underscores the importance of identifying the current sero-prevalence and associated factors of Viral Hepatitis B and C infection among Pregnant women that contribute to helping health authorities in the prevention of HBV and HCV among pregnant women in Alaeen Valley, Hadhramout.

Objectives

The current study aimed to determine the seroprevalence of HBV and HCV infection and associated risk factors among pregnant women attending Antenatal Clinic in Saleh Babker Welfare Hospital Alaeen Valley, Hadhramout Governorate, Yemen.

Methods

A descriptive cross-sectional study was conducted among pregnant women attending obstetrics and gynecology clinic for antenatal care in Saleh Babker Welfare Hospital, Alaeen Valley, Hadhramout Governorate, Yemen. To determine the sero-prevalence of hepatitis B and C infection and associated risk facts, the sample size of the target population was calculated to become 300 Yemeni pregnant women attending antenatal clinics in the study area. The sample size was determined by using Epical program version 2000. Pregnant women attending obstetrics and gynecology clinics for antenatal care were consecutively enrolled until the desired sample size was reached. Data was collected using a close-ended questionnaire. Data including socio-demographic characteristics: Age, residence, education level, occupation, marital status, parity, and risk factors and medical history. A blood specimen was collected for detection of HBsAg and Antibodies to Hepatitis C virus. Data coded and entered into SPSS version 21.0 for descriptive and inferential statistical analysis.

Results

The overall prevalence of hepatitis B and hepatitis C was (3%), and (0,7%), respectively.

The mean age of participating pregnant women was ± SD, 29.37± 6.572 years, about (70%) of them were from semi-urban area, the vast majority of participants (94 %) were married, more than half (51%) of the target pregnant women had basic education, (83%) of them were housewives, and (72%) of them had multigravida. The total (100%) of pregnant women have not had a medical history of taken vaccination to HBV, and not tested for HBV&HCV and there was no history of tattoo. While only (12%) of the participants have had a history of blood transfusion and (17%) of the participants have had a history surgery and (2%) of the participants have had a history liver disease, more than half (63.3%) of them have had a history of dental procedures and (2%) of the participants have had a cupping and in finely (100%) of them had ear piercing. The positivity of prevalence for HBsAg was: about (29.4%) among the age group 37 years and above, (3.3%) among the pregnant women from the semi-urban area, about (5.3%) were with the secondary school educational level, about (5.9%) were separated regarding marital status, and (3.2%) were housewife, and (3.2%) were multi gravida. The positivity of prevalence for Anti HCV was: about (2%) among the age 27-36 years, (1.1%) among the pregnant women from the urban area, about (1.2%) were with the illiterate educational level, about (0.7%) were married regarding marital status, and (0.8%) were housewife, and (1.2%) were primary gravida.

Regarding the overall sero-prevalence of HBsAg and Anti HCV only (3%) and (0.7%) of the participating pregnant women had a positive sero-prevalence of HbsAg and Anti HCV, respectively. The prevalence of HBsAg was about (8%) and the prevalence of anti HCV was (2.8%) among the pregnant women who had a history of blood transfusion. The prevalence of HBsAg was about (66.7%) and the prevalence of anti HCV was (0.7%) among the pregnant women who had a history of liver diseases. The prevalence of HBsAg was about (3.9%) and the prevalence of anti HCV was (2%) among the pregnant women who had a history of surgery, the prevalence of HBsAg was about (3.2%) and the prevalence of anti HCV was (1.1%) among the pregnant women who had a history of dental management. In addition, the prevalence of hepatitis HBsAg (3%) and anti HCV (0.7%) among the participating pregnant women who had a history of ear piercing.

Conclusion

The sero-prevalence of HBsAg was (3%) of moderate severity among the participating pregnant women according to WHO. The sero-prevalence of anti-HCV was found to be (0.7%) among the participating in pregnant women.

There was no statistically significant association between the overall prevalence of hepatitis B virus and hepatitis C virus infection and the demographic characteristics of pregnant women who participated in the study at (P-value >0.05). Although there was a statistically significant association between the overall prevalence of hepatitis B virus infection and the history of liver diseases and the history of blood transfusion of pregnant women at level (P-value <0.05).

Recommendations

Based on the reults of the study we recommende:

Introuction of routine screening for HBV and HCV for all pregnant women attending antenatal clinics in health care centers or hospitals during the antenatal period, using standard precaution and infection control measures to all risk factors, such as blood transfusion, surgery history, liver disease history, dental management, and had an ear-piercing that increasing prevalence of HBV and HCV infection.

Vaccination for HBV is given at birth to newborn infants of mothers found to be HBsAg positive so as to reduce and prevent the spread of infection. However, more data is required from larger studies to support the findings so that, ultimately, this can be recommended as a policy.

ملخص الدراسة

خلفية الدراسة:

يعد الالتهاب الكبدي الفيروسي تحديًا دوليًا للصحة العامة، وهي أمراض رئيسية من مشاكل الصحة العامة في جميع أنحاء العالم. يرتبط التهاب الكبد الفيروسي أثناء الحمل بارتفاع مخاطر الإصابة بمضاعفات تعاني منها المراءة الحامل، بما في ذلك: مقدمات الارتعاج، وشيمة المشيمة، والولادة قبل الأوان، وانفصال المشيمة، ونزيف ما قبل الولادة، والولادة المبكرة، وزيادة حدوث النزف داخل البطيني، وداء السكري الحملي، والوفيات بمعدل مرتفع راسيا حيث أن انتقال العدوى بفيروس التهاب الكبد B و Cيؤدي إلى التهاب الكبد الجنيني والوليدي.

اهداف الدراسة:

هدفت هذه الدراسة إلى تحديد الانتشار المصلي الحالي والعوامل المصاحبة لعدوى الالتهاب الكبدي الفيروسي B وC بين النساء الحوامل المترددات على عيادات النساء والولادة في مستشفى صالح بابكر الخيري وادي العين بمحافظة حضرموت.

طرق البحث:

أجريت دراسة وصفية مستعرضة بين النساء الحوامل اللواتي يراجعن عيادة النساء والولادة من اجل الحصول على رعاية الام الحامل في مستشفى صالح بابكرالخيري للرعاية الصحية بوادي العين، محافظة حضرموت اليمن. ولتحديد الانتشار المصلي للعدوى التهاب الكبد B وC, تكونت عينة الدراسة من 300 امرأة يمنية شاركت في هذه الدراسة. تم تنفيذ هذه الدراسة خلال الفترة من مارس الى يونيو 2019م. حيث تم دراسة المترددات من اجل الحصول على رعاية المراءة الحامل خلال الفترة المذكورة.

النتائج:

أظهرت الدراسة ان اجمالي الانتشار المصلي لفيروس الكبد B وC وسط النساء الحوامل المشاركات في الدراسة كان (3%) و(0.7%) على التوالي. كان متوسط اعمار النساء الحوامل المشاركات بالسنوات هو (Mean ± SD, 29.37± 6.572). أظهرت الدراسة أيضا أن حوالي (70%) من المشاركات ساكنات في المناطق شبة الحضرية، (94 %)متزوجات، (51%) من المشاركات كان لديهن مستوى تعليم اساسي، (83%) من النساء الحوامل يعملن ربات بيوت، كما ان (72%) كنن متعددات الحمل كان النسبة العامة للنساء الحوامل اللواتي لم يلقحن ضد العدوى لفيروس التهاب الكبد B ولم يجرى لهن فحص التحري لخلوهن من الفيروس BوC (100%). في حين أن حوالي (12%) منهم فقط لديهم تاريخ في نقل الدم وحوالي (17%) لديهن عمليات جراحية وأكثر من نصفهم (63,3%) لديهن تاريخ في علاج الأسنان و(2%)

لـديهن تـاريخ فـي امـراض الكبـد (2%) قمـن بعمـل حجامـة (100%) يوجـد لـديهن اخشاف في اذانهن.

أظهـرت النتـائج ان الانتشـار الإيجـابي لـ HBsAg كـان (29.4%) فـي النسـاء الحوامـل التـي كانـت اعمـارهن 37 سـنة وأكثـر. حـوالي (3,3%) مـن النسـاء الحوامـل مـن شـبه الحضـر، و(5.3%) كـان مسـتواهن التعليمـي ثـانوي،(5.9%) كنن منفصلات و (3.2%) كنن ربات بيوت ومتعددات الحمل.

أظهـرت النتـائج ان الانتشـار الإيجـابي لـ Anti HCV كـان (2%) فـي النسـاء الحوامـل التـي كانـت اعمـارهن مـن26- 37 سـنة. وحـوالي (1.1%)) مـن النسـاء الحوامـل مـن المنـاطق الحضـرية وغيـر متعلمـات وذات حمـل اولـي، وكـان (0.7%) كنن متزوجات، (0.8%) كنن ربات بيوت.

واظهـرت الدراسـة ان الانتشـار العـام لفيروسـي الكبـد بنوعيـة البـائي والسـيني كانـت كالتالي

(3%) و (0.7%) موزعة على عوامل الاختطار:

(8.3%) و(2.8%)كـان لـديهن تـاريخ فـي نقـل الـدم و(66.7%) و(0.7%)كـان لـديهن تـاريخ فـي امـراض الكبـد و(3.9%) و(2%) سـوين عمليـات جراحيـة و(3.2%) و(1.1%) لهـن تـاريخ فـي عيـادة الاسـنان (3%) و(0.7%)لـديهن اخشاف في اذانهن

الاستنتاج:

اسـتنتجنا مـن هـذه الدراسـة أن انتشـار فيـروس الالتهـاب الكبـدي B بـين النسـاء الحوامـل المسـتهدفات فـي الدراسـة كـان (3%) وبحسـب توصـيف منظمـة الصـحة العالميـة يعتبـر انتشـار معتـدل. بينمـا الانتشـار المصـلي لفيـروس التهـاب الكبد C كان (0.7%) لدى النساء الحوامل المستهدفات في الدراسة.

أظهـرت الدراسـة بانـه لـم يكـن هنـاك ارتبـاط ذو دلالـة إحصـائية بـين الانتشـار المصـلي العـام لعـدوى التهـاب الكبـد الفيروسـي (B وC) والخصـائص الديموغرافيـة للنسـاء الحوامـل عنـد (P-value>0.05). بينمـا كـان هنـاك ارتبـاط ذو دلالـة إحصـائية بـين الانتشـار المصـلي العـام لعـدوى التهـاب الكبـد الفيروسـي (B وC) والتاريخ الطبي لأمراض الكبد ونقل الدم للحوامل عند المستوى (P-value<0.05).

التوصيات:

بناً على نتائج هذه الدراسة نوصي:

إدخـال الفحـص الروتينـي لفيـروس التهـاب الكبـد B وC لكـل النسـاء الحوامـل المتـرددات علـى عيـادات رعايـة الام الحامـل، اسـتعمال إجـراءات معياريـة لمكافحـة العـدوى لكـل عوامـل الاختطـار مثـل نقـل الـدم والتـدخلات السـنية والجراحيـة وتثقيـب الاذان والتـي فـي حالـة اهمالهـا تزيـد مـن انتشـار العـدوى بفيـروس الكبـد B و C.

التحصـين باللقـاح الخـاص بالتهـاب الكبـد الفيروسـي B بعـد الـولادة مباشـرة للأطفـال الولـودون مـن امهـات لـديهن HBsAg إيجـابي اثنـاء الحمـل وإعطـاء المواليـد جرعـة hepatitis B Immunoglobulin بعـد الولـدة لمنـع انتقـال العـدوى بهـذا

الفيروس في كل الأحوال نحتاج الى معلومات أكثر عن الانتشار لفيروس التهاب الكبد B وC وهذا يتطلب تنفيذ دراسات أكبر من اجل دعم نتائج هذه الدراسة بتوصياتها وتحويلها الى سياسة صحية.

CHAPTER ONE

INTRODUCTION

CHAPTER 1: INTRODUCTION

1.1 Background of the Study

Hepatitis is defined as an inflammation of the liver which results in damage to hepatocytes with subsequent cell death (necrosis) leading to fibrosis or cirrhosis, the liver is a vital organ that processes nutrients, filters the blood, and fights infections. When the liver is inflamed or damaged, its function can be affected. Hepatitis can be caused by a variety of causative agents such as hepatitis A, B, C, D, and E ***(WHO 2016)*** and can also be due to toxins (notably alcohol, certain medications, and plants), other infections, and autoimmune diseases ***(Ahmedin et al. 2004).***

Viral hepatitis is mostly caused by five viruses called hepatitis A, B, C, D, and E. However, hepatitis B and C viruses are of most major concern because of their insidiousness at the early stage of infection and the eventual detection of the disease at a very late stage ***(WHO 2016).***

Viral hepatitis has become a global public health threat affecting millions of people yearly, causing disability and mortality. Viral hepatitis pandemic takes a heavy toll on lives, communities, and health systems. Viral hepatitis is responsible for an estimated 1.4 million deaths per year from acute infection and hepatitis-related liver cancer and cirrhosis ***(WHO 2020).*** Viral Hepatitis in pregnancy caused a very high maternal mortality (19.1%) and fetal wastage (42. 6%) ***(WHO 2020).*** There are an estimated five hundred million people who are chronically infected with the hepatitis B virus (HBV) and Hepatitis C virus (HCV) ***(WHO 2009).***

It is projected that over 2 billion people globally have been infected with HBV of these; over 240 million are chronically infected and stand the chance of developing hepatic diseases that may result in death ***(WHO 2015).***

An estimated 600,000 persons die each year due to the acute or chronic consequences of hepatitis B ***(WHO 2016).*** Viral hepatitis is a major global health concern, affecting 2 - 15 million people each year ***(Aghemo et al. 2012).***

The HBV and the HCV) have infected approximately 400 and 200 million people, respectively, the world ***(Ahmad 2016).*** HCV is also a global health problem that affects about 200 million people worldwide, 3% of the world population living with chronic hepatitis C, while about 3-4 million people were infected every year, and about 350,000 people die every year due to HCV *(**Rubina et al. 2016**).*

HBV and HCV are the most common cause of hepatic dysfunction among pregnant women *(**Esan et al. 2014**)* with an increased risk for complication, especially as this state leave them with a depressed immunity *(**Murad et al. 2013; Kolawole et al. 2012; Oluboyo et al. 2014**).* Pregnancy is not a risk factor for HBV infection *(**Yakassai et al. 2012**).*

Common outcomes of the viral hepatitis infections in mother and neonate lead to liver failure, cirrhosis, hepatocellular carcinoma, *(**Apuzzio et al. 2012**),* postpartum hemorrhage, coagulation defects, jaundice, anorexia, stillbirths, and malaise *(**Esan et al. 2014**).* Infants born to untreated HBV-infected mothers can acquire infection from the mother, mostly during birth. HBV causes hepatitis of altering severity and remains in 95% of children and 10% of adult patients *(**Muhammad et al. 2007**).*

Maternal infection with either HBV or HCV has been linked to adverse pregnancy and birth outcomes, including mother-to-child transmission (MTCT). Mother-to-child transmission for HBV has been reduced to approximately 5% overall in countries including the US that have instituted postpartum neonatal HBV vaccination and immune-prophylaxis with hepatitis B immune globulin ***(Elkhateeb & Kamel 2018).***

Mother-to-child transmission of the hepatitis B virus (HBV) is responsible for more than a third of chronic viral hepatitis infections ***(Ngalula et al. 2018)***. Mother-to-child transmission (MTCT) is responsible for approximately one-half of chronic hepatitis B (CHB) infection worldwide ***(Amsalu et al. 2018).*** Untreated hepatitis B and C viral infections can lead to life treating long-term complications such as liver cirrhosis and cancer ***(Kebede et al. 2018).***

Hepatitis B virus (HBV) and hepatitis C virus (HCV) are the most common viral causes of hepatic diseases universally ***(Xing et al. 2003).*** HBV causes hepatitis of altering severity and remains in 95% of children and 10% of adult patients ***(Muhammad et al. 2007).*** HBV and HCV both share a common mode of transmission through parenteral, sexual, and perinatal means. However, HBV is 50 to 100 times more transmissible than HIV ***(Geberemicheal et al. 2013; Yami et al. 2011).***

Since HBV was the most common cause of hepatitis in pregnant women and is preventable by vaccine, it is recommended that women in the reproductive age group (before the first pregnancy) should receive a full course of hepatitis B vaccine. Hence, the current study aimed to determine the sero-prevalence and associated risk factors of hepatitis B and C among pregnant women attending obstetrics and gynecology clinic for antenatal care.

1.2 Problem Statement

Viral hepatitis is a major global health concern, affecting 2-15 million people each year. The hepatitis B virus (HBV) and the hepatitis C virus (HCV) have infected approximately 400 and 200 million people, respectively, globally ***(Ahmad 2016).*** Viral hepatitis is the eighth primary cause of mortality worldwide, resulting in 1.44 million deaths in 2010 ***(Cruz & Villar 2018).*** Hepatitis B virus (HBV) remains today a major

global pathogen that causes acute and chronic hepatitis, liver cirrhosis, and hepatocellular carcinoma ***(Hu 2018).***

Hepatitis B and hepatitis C viruses are major health problems worldwide. WHO estimates the burden of Hepatitis B virus (HBV) infection at 2 billion, with more than 240 million patients developing chronic infection. Annually 686,000 patients die because of HBV-related liver complications, such as cirrhosis and hepatic carcinoma. Almost one-third of those who develop chronic HBV infections acquire the infection via vertical transmission or horizontally during early childhood ***(Tecle et al. 2018).***

Infection with the hepatitis B virus (HBV) and hepatitis C virus (HCV) causes considerable morbidity and mortality worldwide ***(Perz et al. 2006).*** In Yemen, chronic hepatitis is an important cause of cirrhosis and liver cancer but studies on the prevalence of these viruses in the general population are scarce ***(Jadallah et al. 2005).***

HCV is also a global health problem that affects about 200 million people worldwide, 3% of the world population living with chronic hepatitis C, while about 3-4 million people were infected every year, and about 350,000 people die every year due to HCV ***(Rubina et al. 2016).*** WHO also estimated that about 130–150 million people globally are chronically infected with HCV infection **(*WHO 2015).***

HBV infection during pregnancy is closely related to high risks of maternal complications including pre-eclampsia, placenta praevia, preterm delivery, placental separation, antepartum hemorrhage, preterm lab our, increased incidence of intraventricular hemorrhage, gestational diabetes mellitus, and mortality with a high rate of vertical transmission leading to fetal and neonatal hepatitis. Transmission from mother to infant takes place in the uterine, during delivery, and after birth. Children born to HBsAg+ and hepatitis e antigen (HBeAg+) mothers have a 70–90% chance of prenatal acquisition of HBV infection and over 85–90% of them will eventually become

chronic carriers of the disease. Chronic carriers of HBV are the main reservoirs for the continued transmission of HBV and have a higher risk of hepatocellular carcinoma and liver cirrhosis ***(Tanga et al. 2019).*** Hepatitis B virus (HBV) is recognized as one of the important viruses transmitted transplacentally ***(Tsega et al. 2000).*** Transmission of HBV from positive carrier mothers to their infants may result in neonatal fulminant hepatitis B infection ***(Sterneck et al. 1998).***

Transmission of HBV from mother to infant plays an important role in the maintenance of endemicity, especially in regions where such infections are hyperendemic ***(Michielsen & Van-Dammme 1999).***

Perinatal transmission from an infected mother to her baby is common. About 90% of those infected during the prenatal period, 30% of those infected in early childhood, and 6% of those infected after 5 years of age develop chronic infection ***(Mac & Airiohuodion 2019).***

Viral hepatitis during pregnancy is associated with a high risk of maternal complications. HCV-positive pregnant women appear to be at risk for adverse neonatal and maternal outcomes ***(Pergam et al. 2008).*** Pregnancy does not affect the clinical course of acute or chronic hepatitis C, although several studies have shown improvement in biochemical markers of liver damage in HCV-positive women during pregnancy ***(Conte et al. 2000).*** Vertical transmission of the hepatitis C virus from mother to neonate occurs in 3-10% of pregnancies complicated by maternal HCV infection and is the leading cause of pediatric chronic HCV infection **(*Nasr & Farouk 2019).***

Hepatitis B virus (HBV) infection is a serious global health problem that affects nearly 2 billion people worldwide and approximately 350 million are suffering from chronic HBV infection. HBV is the 10th leading cause of death worldwide. HBV

infections result in 500 000 to 1.2 million deaths per year caused by chronic hepatitis, cirrhosis, and hepatocellular carcinoma ***(Malik 2018).***

Viral hepatitis causes both acute and chronic infections with significant complications and squeal. More than 2 billion people worldwide are estimated to have had hepatitis B virus (HBV) infection, with 350-400 million being chronic carriers of the virus, HBV accounts annually for an estimated 1 million deaths worldwide, and causes acute and chronic liver disease ***(Mac & Airiohuodion, 2019).***

Without any prophylaxis or antiviral therapy, women who are acutely infected with HBV or are chronic carriers of HBV are likely to transmit the virus to their offspring at the time of delivery ***(Amsalu et al. 2018).***

Hepatitis B virus is thought to be the main etiological agent for chronic liver disease (CLD) worldwide. Over 2 billion people today have been infected with HBV and 350 million of them are chronically infected, with annual death of more than 1 million HBV-related CLD ***(Amsalu et al. 2018).***

Hepatitis C virus (HCV) is one of the foremost causes of liver disease worldwide and is also considered as an expected major cause of morbidity and mortality in the future ***(Malik 2018).*** Viral hepatitis during pregnancy is associated with a high risk of maternal complications ***(Nasr & Farouk 2019).***

The risks of HCV infection are associated with active Schistosomiases, blood transfusion, dental treatment, and hospital invasive procedures ***(Nasr & Farouk 2019).***

1.3 Justifications

Viral hepatitis B and C is an international public health challenge. Despite the significant burden it places on communities across all global regions, hepatitis B and C have been largely ignored as a health and development priority until recently. The viral hepatitis B and C pandemic take a heavy toll on lives, communities, and health systems. It is responsible for an estimated 1.4 million deaths per year from acute infection and hepatitis-related liver cancer and cirrhosis a toll comparable to that of HIV and tuberculosis. ***(WHO 2016).*** A few studies have been done in Yemen, but the sero-prevalence and associated factors of viral hepatitis B and C infections among pregnant women in Aleen Valley, Hadhramout Governorate.

The significance of this study, from a researcher's clinical experience, will provide baseline information on sero-prevalence and associated factors of Viral Hepatitis B and C infections among pregnant women in Alaeen Valley, Hadhramout Governorate Yemen.

This study underscores the importance of identifying the current sero-prevalence and associated factors of Viral Hepatitis B and C infections among Pregnant women that contribute to helping health authorities in the prevention of HBV and HCV among pregnant women in Alaeen Valley, Hadhramout.

Therefore, this study aimed to determine the sero-prevalence of hepatitis B and C among pregnant women attending obstetrics and gynecology clinics for antenatal care in Saleh Babker Welfare Hospital Alaeen Valley, Hadhramout Governorate, Yemen.

CHAPTER TWO
LITERATURE REVIEW

CHAPTER II: LITERATURE REVIEW

2.1 Definitions of Hepatitis

Hepatitis is a disease defined by the inflammation of the liver and it is characterized by the existence of inflammatory cells in the tissues of the liver leading to fibrosis or cirrhosis ***(WHO 2016).*** Hepatitis can be caused by a variety of causative agents such as hepatitis A, B, C, D, and E ***(WHO 2016)*** and can be due to toxins (notably alcohol, certain medications, and plants), other infections, and autoimmune diseases ***(Ahmedin et al. 2004).*** Viral hepatitis has become a global public health threat affecting millions of people yearly, causing mortality, disability, and mortality. There are about five hundred million people who are chronically infected with the hepatitis B virus (HBV) or Hepatitis C virus ***(Adade 2016).***

The liver is a vital organ that processes nutrients, filters the blood, and fights infections. When the liver is inflamed or damaged, its function can be affected. In the United States, the most common types of viral hepatitis are Hepatitis A, Hepatitis B, and Hepatitis C ***(CDC 2016).***

2.2 Epidemiology

2.2.1 Epidemiology of HBV Infection

Hepatitis B prevalence is highest in the WHO Western Pacific Region and the WHO African Region, where 6.2% and 6.1%, respectively, of the adult population is infected. In the WHO Eastern Mediterranean Region, the WHO South-East Asia Region, and the WHO European Region, an estimated 3.3%, 2.0%, and 1.6%% of the general population is infected, respectively. 0.7% of the population of the WHO Region of the Americas is infected ***(WHO 2018).***

The most frequent cause of hepatitis is HBV, close to 240 million people are chronically infected, and over 78,000 deaths occur every year ***(Komas et al. 2013).***

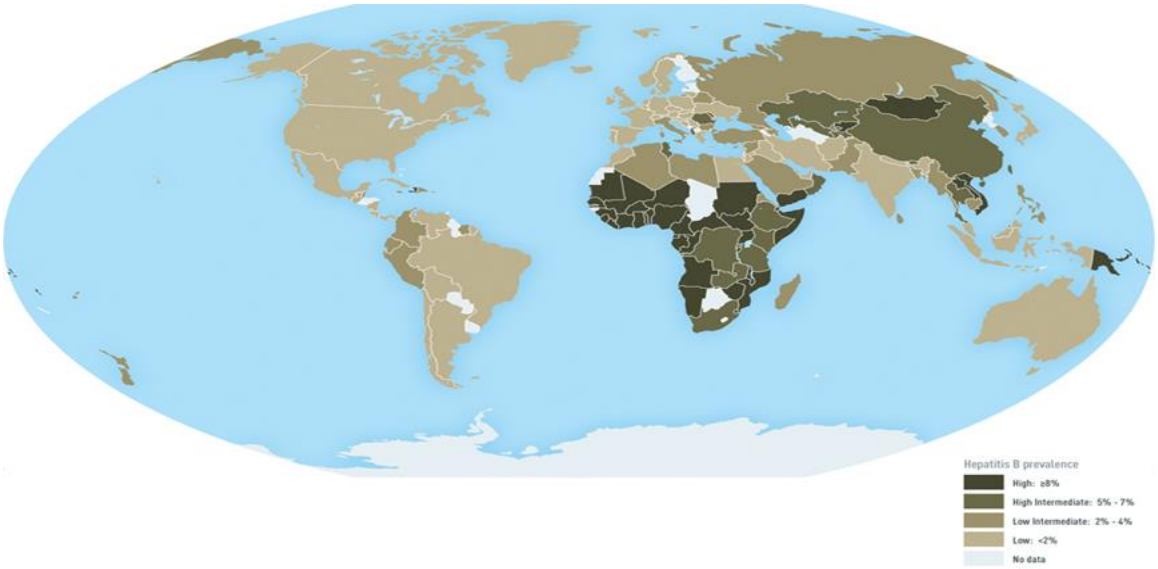

Figure 1: Geographic Distribution of Chronic Hepatitis B Infection, shown as HBsAg prevalence was adapted from ***http://www.cdc.gov/travel-static/yellowbook/2018/map_3-04-small.png***

The prevalence of HBsAg chronic carriers determines the degree of endemicity:

High Endemicity

Hepatitis B is highly endemic in developing countries with a 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 carriers. In these areas, 70-95% of the population shows past or present serological evidence of HBV infection. Most 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 ***(WHO 2018).***

Intermediate Endemicity

Hepatitis B is moderately endemic in parts of Eastern and Southern Europe, the Middle East, Japan, and part of South America. Between 10–60% of the population has 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 chronic infection are maintained mostly by infections occurring in infants and children ***(WHO 2018).***

Low Endemicity

The endemicity of HBV is low in most developed areas, such as North America, Northern, 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 ***(WHO 2018).***

The Situation of HBV in Yemen

The prevalence of positive HBsAg ranges from 8% to 20%, and up to 50% of the populations generally ***(Haidar 2002; Sallam et al. 2003).*** There are severed studies which showed different seroprevalence in a different area of HBsAg are: in Sana'a, 10.5% in Aden 4.75%, in Hajah, 5.6% in Soqotra island 26.3% ***(Bajubair et al. 2008).***

2.2.2 Epidemiology of HCV Infection

It is estimated that 143 million people (2%) of people globally are living with chronic hepatitis C ***(WHO 2011).*** About 3-4 million people are infected per year, and more than 350,000 people die yearly from hepatitis C-related diseases ***(WHO 2011).*** During 2010, it is estimated that 16,000 people died from acute infections, while 196,000 deaths occurred from liver cancer secondary to the infection ***(Lozano 2012).***

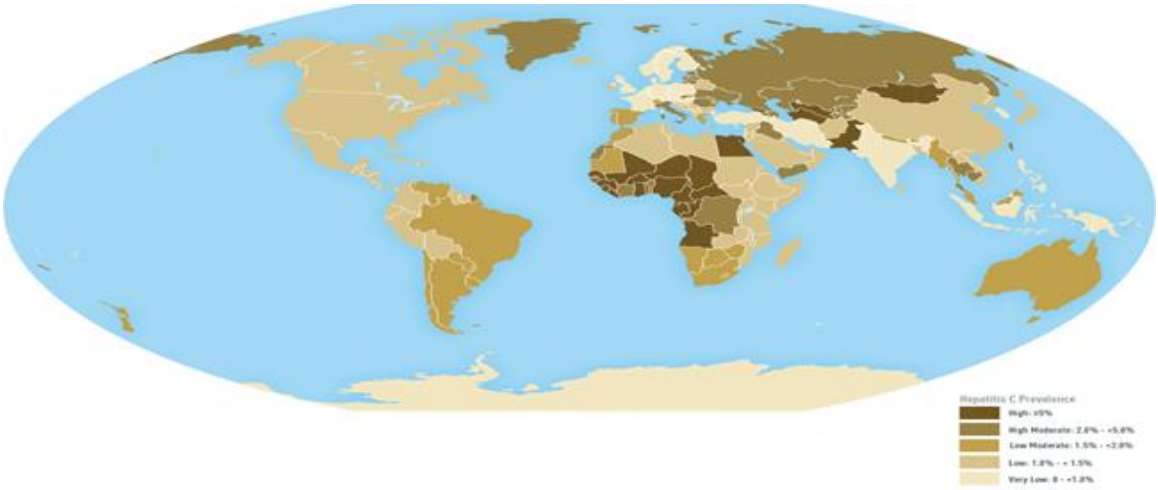

Figure 2: Geographic Distribution of Chronic HCV, shown as HCV prevalence was adapted from ***http://www.cdc.gov/travel-static/yellowbook/2018/map_3-05-small.png***.

High Endemicity

The prevalence of HCV infection is higher (up to 15%) in some countries in Africa and Asia. Countries with higher rates (>3.5%) of chronic infection are Egypt (15%), Pakistan (4.8%), and China (3.2%) ***(Mohd et al. 2013).***

Intermediate Endemicity

They are intermediate (1.5%-3.5%) in South and Southeast Asia, sub-Saharan Africa, Andean, Central, Southern Lirica, Caribbean, Oceania, Australasia Central, Eastern, and Western Europe ***(Mohd et al. 2013).***

Low Endemicity

They are low (<1.5%) in Asia-Pacific, Tropical Latin America, and North America ***(Mohd et al. 2013).***

The Situation of HCV in Yemen

Most of the epidemiological studies were conducted in different cities in Yemen, the prevalence rates of HCV antibodies were: in Sana'a 23 %, in Aden, 0.6 %, in Hajah, 0.8 % in Soqotra island 5.1 % ***(Bajubair et al. 2008).***

2.3 Agents

2.3.1 Hepatitis B Virus

2.3.1.1. A Structure of HBV

Hepatitis B virus (HBV) is a member of the hepadnavirus family ***(Zuckerman 1996)***. The virus particle (virion) consists of an outer lipid envelope and an icosahedral nucleocapsid core composed of the core protein. These virions are 30–42 nm in diameter. The nucleocapsid encloses the viral DNA and a DNA polymerase that has reverse transcriptase activity ***(Locarnini 2004)***. The outer envelope contains embedded proteins that are involved in viral binding of, and entry into, susceptible cells. The virus is one of the smallest enveloped animal viruses. The 42 nm virions, which are capable of infecting liver cells known as hepatocytes, are referred to as "Dane particles**"** ***(Harrison 2009)*.** In addition to the Dane particles, filamentous and spherical bodies lacking a core can be found in the serum of infected individuals. These particles are not infectious and are composed of the lipid and protein that forms part of the surface of the virion, which is called the surface antigens (HBsAg) and is produced in excess during the life cycle of the virus ***(Howard* 1986).**

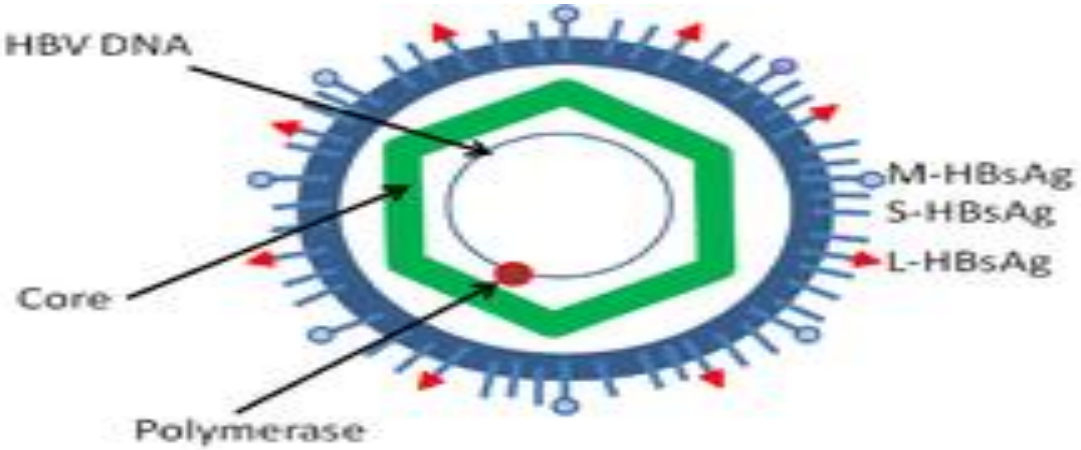

Figure 3: The Structure of Hepatitis B Virus was adopted from ***https:// virology -online.com/ Hepatitis B Virus Infection.htm.***

2.3.1.2.B Genome of HBV

The genome of HBV is made of circular DNA, but it 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 the short length-strand) ***(Kay & Zoulim 2007).*** The negative-sense (non-coding) is complementary to the viral mRNA. The viral DNA is found in the nucleus soon after infection of the cell. The partially double-stranded DNA is rendered fully double-stranded by the completion of the (+) sense strand and removal of a protein molecule from the (−) sense strand and a short sequence of RNA from the (+) sense strand. Non-coding bases are removed from the ends of the (−) sense strand and the ends are rejoined. There are four known genes encoded by the genome, called C, X, P, and S. The core protein is coded for by gene C (HBcAg), and its start codon is preceded by an upstream in-frame AUG start codon from which the pre-core protein is produced. HBeAg is produced by proteolytic processing of the pre-core protein. In some rare strains of the virus known as Hepatitis B virus precore mutants, no HBeAg is present ***(Buti et al. 2005)***

The DNA polymerase is encoded by gene P. Gene S is the gene that codes for the surface antigen (HBsAg). The HBsAg gene is one long open reading frame but contains three in frame "start" (ATG) codons that divide the gene into three sections, pre-S1, pre-S2, and S. Because of the multiple start codons, polypeptides of three different sizes called largely (the order from the surface to the inside: pre-S1, pre-S2, and S), middle (pre-S2, S), and small (S) are produced ***(Glebe et al. 2007).*** There is a myristyl group, which plays an important role in infection, on the amino-terminal end of the preS1 part of the large (L) protein ***(Watashe et al. 2015).*** In addition to that, the N terminus of the L protein has virus attachment and capsid binding sites. Because of that, the N termini of half of the L protein molecules are positioned outside the membrane and the other half positioned inside the membrane ***(Carter 2013).***

The function of the protein coded for by gene X is not fully understood but it is associated with the development of liver cancer. It stimulates genes that promote cell growth and inactivates growth-regulating molecules ***(Li et al. 2010).***

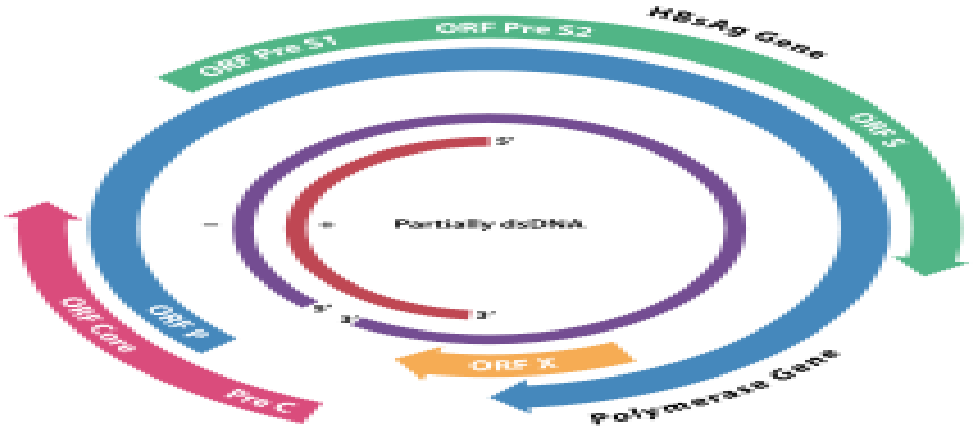

Figure 4: The Genome Organization of HBV. The genes overlap was adopted from ***https://en.wikipedia.org/wiki/hepatitis _B virus DNA_ polymerase.***

2.3.2 Hepatitis C Virus

2.3.2.1. A Structure of HCV

Hepatitis C virus (HCV) is a small (55-65 nm in size), enveloped sense single-strand virus, the family Flaviviridae ***(Kato et al. 2000)***. Hepatitis C virus particle consists of a lipid membrane envelope that is 55 to 65 nm in diameter ***(Dubuisson et al. 2014).*** Two viral envelope glycoproteins, E1, and E2 are embedded in the lipid envelope ***(Beeck & Dubuisson 2003).*** They take part in viral attachment and entry into the cell ***(Dubuisson et al. 2014).*** Within the envelope is an icosahedral core that is 33 to 40 nm in diameter ***(Kaito et al. 2006)***. Inside the core is the RNA material of the virus ***(Dubuisson et al. 2014).***

E1 and E2 are covalently bonded when embedded in the envelope of HCV and are stabilized by disulfide bonds. E2 is globular and seems to protrude 6 nm out from the envelope membrane according to electron microscope images ***(Kaito et al. 2006)***. These glycoproteins play an important role in the interactions hepatitis C has with the immune system. The hypervariable region 1 (HVR1) can be found on the E2

glycoprotein ***(Dubuisson et al. 2014).*** HVR1 is flexible and quite accessible to surrounding molecules ***(Castelli et al. 2017).*** HVR1 helps E2 shield the virus from the immune system. It prevents CD81 from latching onto its respective receptor on the virus ***(Basu et al. 2004).*** In addition, E2 can shield E1 from the immune system ***(Castelli et al. 2017)***. Although HVR1 is quite variable in amino acid sequence, this region has a similar chemical, physical, and conformational characteristic across many E2 glycoproteins ***(Basu et al. 2004).***

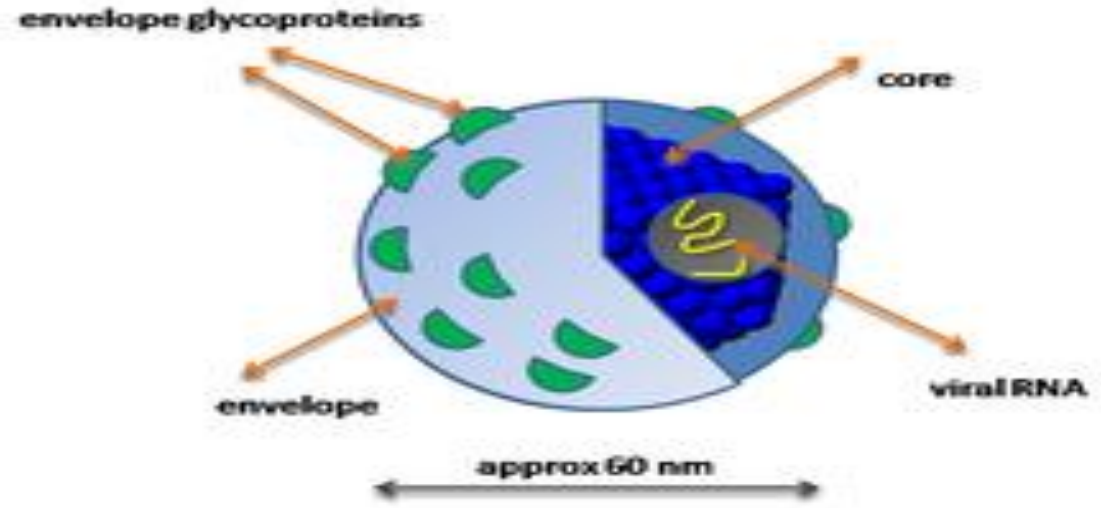

Figure 5: Structure of Hepatitis C Virus was adopted from ***https:// virology - online.com/ Hepatitis C Virus Infection.htm.***

2.3.2.2. B Genome of HCV

Hepatitis C virus has a positive-sense single-stranded RNA genome. The genome consists of a single open reading frame that is 9600 nucleotide bases long ***(Kato 2000)***.

At the 5' and 3' ends of the RNA are the UTR, that are not translated into proteins but are important to translation and replication of the viral RNA. The 5' UTR has

a ribosome binding site ***(Jubin 2001).*** Alternatively, an internal ribosome entry site (IRES) that initiates the translation of a very long protein containing about 3,000 amino acids. (The core domain of the HCV IRES contains a four-way helical junction that is integrated within a predicted pseudoknot ***(Berry et al. 2011).*** The confirmation of this core domain constrains the open reading frame's orientation for positioning on the 40S ribosomal subunit. The large pre-protein is later cleaved by cellular and viral proteases into the 10 smaller proteins that allow viral replication within the host cell or assemble into the mature viral particles ***(Dubuisson 2007).***

Structural proteins made by the hepatitis C virus include Core protein, E1, and E2; nonstructural proteins include NS2, NS3, NS4A, NS4B, NS5A, and NS5B.

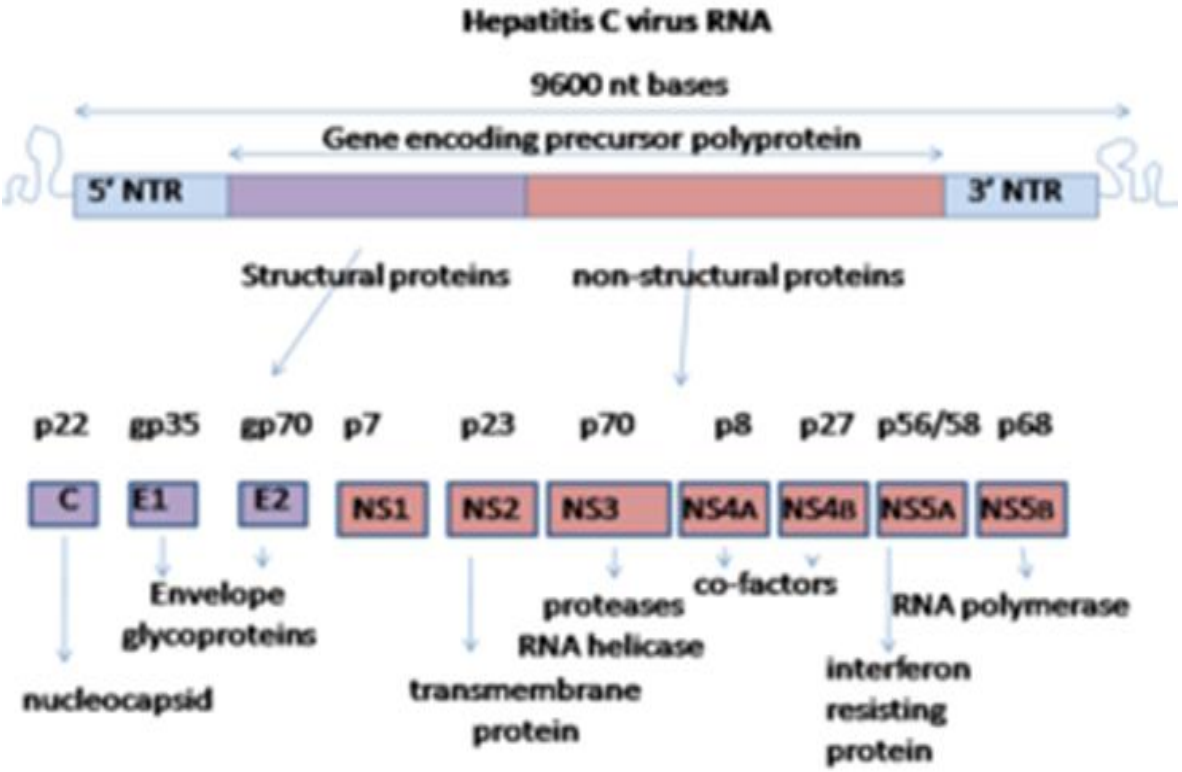

Figure 6: Summary of HCV genomic organization was adapted from ***https:// virology -online.com/ Hepatitis C.*** ***(Genomic organization of HCV. In Wikipedia.***

2.4 Reservoir of Infection

2.4.1 Reservoir of Infection for HBV

The reservoir of HBV is humans. Chimpanzees are susceptible, but an animal reservoir in nature has not been recognized. Closely related hepadnavirus is found in woodchucks, ducks, ground squirrels, and other animals, such as snow leopards and German herons; none cause disease in humans ***(David 2010).***

2.4.1 Reservoir of Infection for HCV

The reservoir of HCV is humans; the virus has been transmitted experimentally to chimpanzees ***(David 2010).***

2.5 Mode of Transmission

2.5.1 Mode of Transmission of HBV Infection

The route of transmission is parenteral, sexual, and exposure to HBsAg positive blood or other body fluids from carriers of HBV or from those who have acute hepatitis ***(Anwar et al. 2016).*** HBV can be transmitted via direct contact with blood, transfusion of blood and blood products, intravenous injections, and unprotected sex, the prevalence of risk factors differs from a society to another according to the norms and traditions of that society. Therefore, for the establishment of a public health plan to combat HBV infection, determining the risk factor of infection transmissions in society is of great importance ***(Hussein & Daniel 2017).*** It can be transmitted parentally by mothers infected with HBV; percutaneous (e.g., IV drug use, accidental needle-stick punctures); or by mucosal exposure to infectious blood, blood products, or other body fluids (e.g., semen, vaginal secretions, saliva) ***(Lewis et al. 2014).***

Hepatitis B can be passed from an infected mother to her baby at birth. Worldwide, most people with Hepatitis B were infected with the virus as an infant ***(CDC 2016).***

2.5.2 Mode of Transmission of HCV Infection

Transmission of HCV infection is mainly by exposure to infected devices and tools despite rigid hygienic control, infected blood or blood products, hemodialysis, intravenous (IV) drug abuse, and organ transplantation. The estimation of national prevalence and ways of transmission of HCV should be completed in order to allow the national authorities to prioritize preventive measures and have the best and most appropriate use of available resources ***(Ashkani-esfahani et al. 2017).*** Moreover, due to the great variety of human activities with potential exposure to blood, several possible biologic transmission models exist, such as from tattoos, piercings, barbershops, scarification rituals, circumcisions, and acupuncture ***(Monsalve-Castillo et al. 2012).***

2.6 Susceptibility

2.6.1 Susceptibility of HBV

Regarding the susceptibility to HBV infection in general, the disease is often milder and anicteric in children; in infants, it is usually asymptomatic. Persons with Down syndrome, lymph proliferative disease, HIV infection, and those on hemodialysis appear more likely to develop chronic HBV infection ***(Heymann 2010).***

2.6.2 Susceptibility of HCV

In HCV, the susceptibility is general. The degree of immunity following infection is not known; repeated infections with HCV have been demonstrated in an experimental chimpanzee model ***(Heymann 2010).***

2.7 Risk Factor

2.7.1 Risk Factor of HBV

Risk factors for HBV infection including, frequent exposure to blood, blood products, or other body fluids; exposure of health care workers: hemodialysis staff, oncology. and chemotherapy nurses, personnel at risk for needle sticks, operating room staff, respiratory therapists, surgeons, dentists; hemodialysis; male homosexual and bisexual activity; IV/injection drug use; close contact with a carrier of HBV; Travel to or residence in an area with uncertain sanitary conditions; multiple sexual partners; recent history of the sexually transmitted disease; receipt of blood or blood products (e.g., clotting factor concentrate) ***(Smeltzer et al. 2013).***

Pregnancy appears to be a potential risk factor for viral replication and leads to the extremely low immune status of pregnant women ***(Jethwadk et al. 2016).*** Pregnant women are considered at a higher risk due to increased exposure to risk factors (as blood transfusion, intravenous drugs, or surgical procedures ***(El-shabrawi 2016).***

The risk of HBV transmission through the perinatal route depends on the presence of HBeAg in the blood of mothers infected with HBV. Reports from the African continent have documented that children born to mothers seropositive for both HBsAg and HBeAg are thought to have a pooled risk of 38.3% getting the infection if not given appropriate immune prophylaxis ***(Tecle et al. 2018).***

HBV positive mothers with an HBsAg positive status can vertically transmit the infection to their infants. This risk of transmission may increase if the mother develops the HBV infection during the third trimester of pregnancy ***(Ahmad 2016).***

2.7.2 Risk Factor of HCV

Risk factors for HCV infection include blood transfusion and blood products from non-tested blood donors; organ transplantation from infected donors, administration of drugs with contaminated syringes, hemodialysis, and occupational exposure to blood, perinatal infection, and sexual transmission ***(Monsalve-Castillo et al. 2012).***

Epidemiological surveys on the roles of potential risk factors, such as injections for medications, vaccinations, medical procedures, tattooing, and injection outside of medical settings, have shown a wide geographical variation with major implications for the populations and potential management, prevention, and control plans ***(Ashkani-esfahani et al. 2017).***

2.8 Incubation Period

2.8.1 Incubation Period of HBV

The incubation period for HBV infection is six weeks to six months ***(Anwar & Imran 2016).*** HBV has a long incubation period. It replicates in the liver and remains in the serum for relatively long periods, allowing transmission of the virus. HBsAg appears in the circulation in 80% to 90% of infected patients 1 to 10 weeks after exposure to HBV and 2 to 8 weeks before the onset of symptoms or an increase in transferase levels. Patients with HBsAg that persists for 6 months or longer after acute infection are considered HBsAg carriers ***(Smeltzer et al. 2013).***

2.8.2 Incubation Period of HCV

The incubation period for HCV infection varies from 14 to 180 days. Following acute infection, which is usually asymptomatic or occurs as a mild clinical disease, chronic HCV infection develops in 75%–85% of patients ***(Kizilates et al. 2016).***

2.9 Clinical Manifestations

2.9.1 Clinical Manifestations of HBV

Many people with Hepatitis B do not have symptoms and do not know they are infected. If symptoms occur, they can include fever, feeling tired, not wanting to eat, upset stomach, throwing up, dark urine, grey-colored stool, joint pain, and yellow skin and eyes ***(CDC 2016).***

Clinical signs and symptoms of HBV infection during the acute phase are the same as those of HAV infection. Arthralgia, high fever, and rash are hallmark signs of an acute HBV infection ***(Morton & Fontaine 2017).*** The patient may have a loss of appetite, dyspepsia, abdominal pain, generalized aching, malaise, and weakness. Jaundice may or may not be evident. If jaundice occurs, light-colored stools and dark urine accompany it. The liver may be tender and enlarged to 12 to 14 cm vertically. The spleen is enlarged and palpable in a few patients; the posterior cervical lymph nodes may also be enlarged. Subclinical episodes also occur frequently ***(Smeltzer et al. 2013).***

2.9.2 Clinical Manifestations of HCV

Patients with HCV infection may present with a variety of symptoms that are not necessarily related to liver diseases, such as fatigue, arthralgia, myalgia, or Sicca-like syndrome. These symptoms can be related to the EHMs of HCV infection ***(Howard et al. 2014).***

2.10 Co-infection

HBV/HCV co-infection was related to a longer time on hemodialysis, longer duration of infection, and a history of blood transfusion ***(Xiong et al. 2016).*** Persons at risk for HCV infection are also at risk for HBV and HIV infections. About 30% to 40% of HIV-infected patients also have HCV. This high rate of co-infection is primarily related to IV drug use. Co-infection with HIV and HCV places the patient at greater risk for progression to cirrhosis ***(Lewis et al. 2014).***

2.11. Pathogenesis

2.11.1 Pathogenesis of HBV Infection during Pregnancy

HBV mothers had an increased risk of gestational diabetes mellitus, antepartum hemorrhage, and threatened preterm labor, hepatitis B seropositive pregnant women had higher rates of preterm deliveries, premature rupture of membranes, placental abruption, labor induction, and cesarean deliveries, as also of Perinatal mortality, congenital malformations, and low birth weight. Most of these women did not have cirrhosis or portal hypertension, suggesting that the obstetric complications were related to a chronic inflammatory state. Chronic HBV infection is associated with increased levels of pro-inflammatory cytokines, such as IL-2, IL-6, IL-10, macrophage migration inhibitory factor, and tumor necrosis factor-alpha ***(Kumar et al. 2010).***

Chronic HBV infection in pregnancy presents a unique challenge, because of the existence of a complex relationship between the physiological changes of pregnancy and the pathophysiological response of the body to HBV. Thus, HBV-infected pregnant women may have varied clinical presentations ***(Kumar et al. 2010).***

2.11.2 Pathogenesis of HCV Infection during Pregnancy

The pathogenesis of HCV infection during pregnancy remains poorly understood. During pregnancy, the maternal immune system must at the same time develop tolerance to paternal alloantigen to prevent maternal immune aggression against the fetus and maintain active immunity against HCV to protect both mother and fetus from infection ***(Nasr & Farouk 2019).***

2.12 Complications

2.12.1 Complication of HBV during Pregnancy

Viral hepatitis during pregnancy is associated with a high risk of maternal complications. It has a high risk of vertical transmission and it is the leading cause of maternal death ***(Ahmad 2016).***

Viral hepatitis in pregnancy can lead to coagulation defects, postpartum hemorrhage, organ failure, high maternal mortality, and poor outcomes of their newborns, such as stillbirths, neonatal deaths, acute and chronic liver disease, and hepatocellular carcinoma. So early diagnosis and treatment is required for better management of the patients ***(Dv et al. 2016).***

HBV causes an acute or chronic infection. Adults with normal immunity experience infection at a rate of 94%-98% after exposure to the virus and acquire permanent immunity with neutralizing antibodies. However, immunosuppressed individuals, such as patients who are infected often develop chronic infection ***(Kizilates et al. 2016).***

2.12.2 Complication of HCV during Pregnancy

Viral hepatitis C during pregnancy is associated with a high risk of maternal complications. HCV-positive pregnant women appear to be at risk for adverse neonatal and maternal outcomes. Pregnancy does not affect the clinical course of acute or chronic hepatitis C, although several studies have shown improvement in biochemical markers of liver damage in HCV-positive women during pregnancy. Vertical transmission of the hepatitis C virus from mother to neonate occurs in 3-10% of pregnancies complicated by maternal HCV infection and is the leading cause of pediatric chronic HCV infection. The risk of vertical transmission of HCV appears to be related to the level of viremia in the pregnant mother and not to the route of infection ***(Nasr & Farouk 2019).***

Chronic hepatitis C virus (HCV) infection, which affects 130–150 million people worldwide, is one of the leading causes of liver cirrhosis and hepatocellular cancer, as well as a leading indication for liver transplantation in developed countries ***(WHO 2015).*** In addition, several extra-hepatic complications, such as dermatologic, rheumatologic, and hematologic disorders, are associated with chronic HCV ***(Jukic et al. 2017).*** They are also well documented in patients with chronic HCV. However, it is not clear whether and to what extent chronic HCV infection affects the development and progression of chronic kidney disease (CKD) at a population level ***(Li & Lo 2015).***

2.13 Diagnosis

2.13.1 Diagnosis of HBV Infection

The diagnosis of HBV infection is typically based on the evaluation of serological and Virological markers of HBV in serum as well as the evaluation of biochemical and histological markers of the liver ***(Keeffe et al. 2006).***

2.13.1.1Biochemical Assays

The biochemical assessment of liver function includes total and direct bilirubin (TSB), alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), total protein, albumin, globulin, and coagulation profile ***(Burakoff 2020).***

2.13.1.2 Serological Diagnosis of HBV

The most useful detection methods are Rapid Diagnosis Test and ELISA for detecting HBV antigens or antibodies ***(Jawetz et al. 2007).*** The detection of serological markers is based on the Ag-Ab reaction, therefore divided into two classes, detection of Ags or detection of Abs**.**

2.13.1.2.1 Rapid Diagnosis Test

A rapid diagnostic test, which is endorsed by the WHO can detect HBV detection of Ags or detection of Abs in the blood, antibodies are produced by the immune cells that your body uses to fight infection. This test has several advantages. It only requires a small amount of blood, it can be done without a lab, and it does not need to be performed by healthcare workers who have extensive training. The WHO describes it as similar to a pregnancy test. The results are ready in about 20 minutes. If you test positive for HBV with a rapid diagnostic test, it is recommended that you have a different test to confirm your diagnosis because the rapid diagnostic test can show antibodies even if you have effectively fought off the infection but do not have a current infection detection of Abs in the blood, antibodies are produced by the immune cells that your body uses to fight infection ***(WHO 2020)***.

2.13.1.2.2 Enzyme linked Immunosorbent Assay (ELISA)

ELISA for detecting HBV antigens or antibodies based on Ag-Ab reaction, therefore divided into two classes, detection of Ags or detection of Abs ***(Jawetz et al. 2007).***

2.13.1.2.2. A Detection of HBV Antigens

2.13.1.2.2. A.1 Detection of HBsAg

Hepatitis B surface antigen is the first serological marker to appear after infection. Its persistence for more than 6 months indicates CHB infection ***(Keeffe et al. 2006).*** HBsAg appears at an average of 6-8 weeks after exposure, 1-3 weeks before ALT becomes abnormal and 3-5 weeks before the onset of symptoms or jaundice ***(Alter 2003).*** This Ag can be detected by many techniques; the commonly used ones are radioimmunoassay (RIA) and enzyme immunoassay. Since many immunoassays use monoclonal antibodies directed against the "a" determinant, amino acid substitution in this region may account for false-negative results in an immunoassay ***(Levicnic-Stezinar 2004).*** Thus, diagnosticians and the health care industry need to increase their awareness of HBsAg mutation and how these mutants may alter current diagnostic and treatment algorithms ***(Coleman 2006).***

2.13.1.2.2. A.2 Detection of HBeAg

The presence of HBeAg indicates active viral replication. However, its absence cannot be assumed to equate to the absence of viral replication because HBeAg is not detectable in patients with HBeAg-negative HBV infection ***(Keeffe et al. 2006).***

Highly sensitive assays, such as passive hemagglutination and RIA have demonstrated that HBeAg appears simultaneously or within a few days of the appearance of HBsAg

in all or almost primary infection ***(Jawetz et al. 2007)***. In CHB infection, HBeAg may persist for years before seroconversion to anti-HBe ***(Saab & Martin 2000).***

2.13.1.2.2. A.3 Detection of HBcAg

Hepatitis B core antigen is an intracellular antigen that is expressed in infected hepatocytes. It is not detectable in serum ***(Lin & Kirchner 2004).***

2.13.1.2.2 B Detection of HBV Antibodies

2.13.1.2.2 B.1 Anti-HBs Antibodies

Replace HBsAg as AHB infection is resolving. It generally persists for a lifetime in over 80 % of patients and indicates immunity ***(Hollinger & Liang 2001).*** Occasionally, anti-HBs and HBsAg are both detectable in patients with CHB infection, a finding of no known significance ***(Keeffe et al. 2006).*** Anti-HBs may not be detectable until after a window period of several weeks to months ***(Berenguer & Wright 2002).*** This marker is acquired through natural HBV infection, vaccination, or passive antibody immunization ***(Lin & Kirchner 2004).*** The level of circulating anti-HBs is used to determine the effectiveness of vaccination and in the USA an antibody level of 10 ml u / ml or higher indicates immunity ***(Schiff 2004).***

2.13.1.2.2 B.2 Anti-HBc Antibodies

It is the first antibody to appear. Demonstration of anti-HBc in serum indicates HBV infection, current or past. Anti-HBc IgM is present in high titer during acute infection and usually disappears within 6 months, and although it can persist in some cases of chronic infection, this test may therefore reliably diagnose AHB infection ***(Hollinger & Liang 2001).*** High levels of IgM-specific anti-HBc are frequently detected at the onset of illness because this antibody is directed against. The 27 nm

internal core component of HBV and it is the appearance in the serum that indicates viral replication ***(Jawetz et al. 2007).***

Anti-HBc IgG predominates after 6 months and generally persists indefinitely in patients who have recovered from HBV infection. Anti-HBc IgG present in virtually all patients who have ever been exposed to HBV ***(Hollinger & Liang 2001; Lin & Kirchner 2004).*** Anti-HBc total is used with anti-HBs and HBsAg for screening populations at risk ***(Schiff 2004).***

2.13.1.2.2 B.3 Anti-HBe Antibodies

Hepatitis Be Ag is replaced by anti-HBe, signaling the start of the resolution of disease. Anti-HBe levels often are no longer detectable after 6 months ***(Jawetz et al. 2007).*** Its presence in CHB infection indicates the onset of the non-replicative phase ***(Saab & Martin 2000; Lin & Kirchner 2004).*** Generally, HBeAg seroconversion to anti-HBe has been considered the endpoint for HBV therapy for HBeAg-positive (wild type) patients, because it has shown to be associated with a lower risk for disease progression, although not protective against later development of HCC ***(Keeffe et al. 2006).***

2.13.1.3 Polymerase Chain Reaction Technique (PCR)

Hepatitis B virus DNA detection based on a nested PCR approach can detect as few as 102 -103genome copies ***(Schutten & Niesters 2001)***. It is at least 10 times more sensitive than dot blot assays for HBV-DNA ***(Soni et al. 1994).*** The amount of HBV-DNA in serum is a measure of the level of viral replication. Previously, serum HBV-DNA testing was performed using non-amplified hybridization. These assays (Dot blot hybridization, Liquid hybridization, North blot, and branched DNA assays) have a limit

of quantification of 105-106copies / ml and should no longer be used for routine management of patients with CHB infection ***(Keeffe et al. 2006).***

Serological profiles fall outside of the classical pattern. The molecular testing of HBV consists of two categories. First, HBV-DNA quantification assays that measure the amount of HBV-DNA in peripheral blood, which reflects the level of HBV replication (viral load) in the liver. Second, the assays that identify sequences or motifs of clinical or pathophysiological importance in the HBV genome ***(Pallier et al. 2006).***

2.13.2 Diagnosis of HCV Infection

HCV infection shows signs and symptoms that are very similar to those of other infections early on, can be confirmed with antibody tests and detection of the virus in the blood. If you have been exposed to HCV, or if you have signs that suggest you may have HCV infection, you should be tested for the infection ***(Burakoff 2020).***

2.13.2.1 Biochemical Assay

The biochemical assessment of liver function includes total and direct bilirubin (TSB), alanine aminotransferase (ALT), aspartate aminotransferase (AST), alkaline phosphatase (ALP), total protein, albumin, globulin, and coagulation profile ***(Burakoff 2020).***

2.13.2.2 Serological Diagnosis of HCV

2.13.2.2.1 Rapid Diagnostic Test

This is a rapid diagnostic test, which is endorsed by the WHO can detect HCV antibodies in the blood, antibodies are produced by the immune cells that your body uses to fight infection. This test has several advantages. It only requires a small amount of blood, it can be done without a lab, and it does not need to be performed by healthcare

workers who have extensive training. The WHO describes it as similar to a pregnancy test. The results are ready in about 20 minutes. If you test positive for HCV with a rapid diagnostic test, it is recommended that you have a different test to confirm your diagnosis because the rapid diagnostic test can show antibodies even if you have effectively fought off the infection but do not have a current infection ***(WHO 2020)***.

2.13.2.2.2 Enzyme-linked Immunosorbent Assay (ELISA)

HCV infections are confirmed by a blood test that detects antibodies specific to the virus. The test is very sensitive, but not very selective in looking for antibodies, so a positive ELISA might not be correct. On average, it takes four to ten weeks for the body to produce enough antibodies for a test to be considered accurate ***(CDC 2019).*** ELISA is considered the gold standard in HCV antibody testing, but, like the rapid test, results may be positive even if you are not infected if you have been infected and effectively fought off HCV in the past ***(Burakoff 2020).***

2.13.2.3 Polymerase Chain Reaction Technique (PCR)

HCV RNA PCR test is conducted through a process called polymerase chain reaction (PCR). There are two approaches to this process: qualitative and quantitative ***(Jewell 2020).***

2.13.2.2.3. A HCV RNA Qualitative Test

1. This test is often used to make an HCV diagnosis. It confirms whether you have the virus in your body, but it doesn't reveal how much of the virus is present.
2. The qualitative test is often the second test that a doctor will use to confirm whether HCV is present in the blood. It typically follows the HCV antibody test.
3. The antibody test indicates whether your body is making antibodies to fight off an HCV infection. If you test positive for HCV antibodies, your doctor will use

HCV RNA PCR testing to confirm and measure the amount of HCV in your blood.

4. Your doctor may also recommend a similar qualitative test known as transcription-mediated amplification (TMA) test. Some research Trusted Source suggests that it's a much more sensitive detection test for HCV. Your doctor may not think that it is necessary for you if the PCR test gives sufficient results ***(Jewell 2020).***

2.13.2.4.2 HCV RNA Quantitative Testing

1. This test method measures the exact amount of the HCV in your blood in international units per milliliter (IU/mL). This number determines whether you have a high or low viral load.
2. The quantitative test is useful for monitoring the amount of HCV in your blood over time or measuring your response to treatment intended to reduce your viral load.
3. Once the measurement of your viral load drops to 15 IU/mL or fewer, the amount of the virus is considered undetectable. At this point, the qualitative test can confirm whether the virus is no longer in your body or if only a small amount is, still present ***(Jewell 2020).***

2.14 Treatment

2.14.1 Treatment of HBV Infection

Treatment of chronic HBV infection during pregnancy is mostly supportive. Patients need to be monitored periodically with liver function tests during pregnancy. A small subset of HBV infected women with rapidly progressive chronic liver disease may be treated with antiviral medications ***(Navabakhsh et al. 2011)*.**

Seven antiviral medications are currently FDA-approved for the treatment of

Table 1: Approved Therapies for Treatment of Hepatitis B*

	Interferon alfa-2b	Pegylated Interferon alfa-2a	Lamivudine[b]	Adefovir	Telbivudine	Entecavir	Tenofovir
Mechanism	Immuno-modulator	Immuno-modulator	Nucleoside analogue	Nucleotide analogue	Nucleoside analogue	Nucleoside analogue	Nucleotide analogue
Pregnancy Category	C	C	C	B	B	C	B
Adult Dosage	5 MIU subcutaneously Once daily for 16 weeks	180 µg subcutaneously Once weekly for 48 weeks	100 mg orally Once daily	10 mg orally Once daily	600 mg orally Once daily	0.5–1.0 mg orally Once daily	300 mg orally Once daily
Most Common Side Effects	Depression, muscle aches, fatigue, low-grade fevers	Depression, muscle aches, fatigue, low-grade fevers	Headache, fatigue, diarrhea, and ear, nose, throat infections	Asthenia, headache, nausea, diarrhea, flatulence, dyspepsia	Headache, fatigue, diarrhea, dyspepsia, rash, myopathy	Headache, fatigue, diarrhea, dyspepsia	Asthenia, headache, nausea, diarrhea, rash, depression

[a] Data from product package inserts.

[b] Lamivudine is widely used in pregnancy among HIV-infected women with no known increased adverse outcomes for mother or infant, and there has also been a lot of experience with tenofovir being used in the third trimester of pregnancy of these women as well.

hepatitis B. A more thorough discussion of these medications and recommendations for treatment can be found in the evidence-based guidelines developed by the American Association for the Study of Liver Diseases Practice Guidelines Committee ***Apuzzio et al. 2012)***

Therapies for the Treatment of Hepatitis B table were adopted from ***(Apuzzio et al. 2012).***

The American College of Gastroenterology (ACG) and AASLD guidelines both strongly recommend initiation of antivirals in highly viremia patients at 28–32 weeks of gestation to reduce MTCT ***(Ayoub & Cohen 2016).***

The main goal of antiviral therapy in pregnant patients is to reduce the rates of vertical transmission. Immunoprophylaxis with HBIG and HBV vaccination immediately after birth that is followed by completion of the vaccination series has been used to prevent MTCT in the setting of HBsAg-positive mothers ***(Ayoub & Cohen 2016).***

The American College of Gastroenterology (ACG) and AASLD guidelines both strongly recommend initiation of antivirals in highly viremia patients at 28–32 weeks of gestation in order to reduce MTCT. The main goal of antiviral therapy in pregnant patients is to reduce the rates of vertical transmission. Immunoprophylaxis with HBIG and HBV vaccination immediately after birth that is followed by completion of the vaccination series has been used to prevent MTCT in the setting of HBsAg-positive mothers ***(Ayoub & Cohen 2016).***

Table 2: Treatment Option for Chronic HVB in Pregnant

Drug and dose	Indication	Pregnancy category	Potential side effects	Risk of resistar
Peg-IFN 2a 180 μg/week (Finite therapy may be used prior to conception)	HBV (HBeAg-positive or -negative), compensated disease, viral replication, liver inflammation	C‡	Flu-like symptoms, fatigue, depression, cytopenias, autoimmune disorders	Low
Lamivudine 100 mg/d	Chronic HBV with viral replication and liver inflammation	C‡	Pancreatitis, lactic acidosis	High
Telbivudine 600 mg/d	Chronic HBV with viral replication, transaminitis, or active histology	B**	Myopathy, creatinine kinase elevation, lactic acidosis	Modera
Entecavir 0.5-1 mg/d	Chronic HBV with active viral replication	C‡	Lactic acidosis	Low in HBV na patients
Adefovir 10 mg/d	Chronic HBV	C‡	Acute renal failure, Fanconi syndrome, nephrogenic diabetes insipidus, lactic acidosis	Modera
Tenofovir 300 mg/d	Chronic HBV	B**	Nephropathy, Fanconi syndrome, osteomalacia, lactic acidosis	Low

The Approved Therapies for the Treatment of Hepatitis B table was adopted from ***(Apuzzio et al. 2012)***

2.14.2 Treatment of HCV Infection

Recent advances in hepatitis C therapy have made a huge impact on the lives of people who have the infection, particularly when you consider that HCV was only officially identified in 1989. Direct-acting antivirals (DAAs) produce cure rates of as high as 99 percent in some groups. DAAs generally work by interrupting the life cycle of the virus. Other medications can also be used along with DAAs, and a liver transplant may be an option for some people with late-stage HCV infection is generally recommended when a person shows signs of liver inflammation. The course and duration of therapy are determined by the genotype of a person's virus, as well as the diagnosed stage of infection ***(Burakoff 2020).***

The most common Direct-acting antivirals (DAAs) include Epclusa (sofosbuvir/velpatasvir), Sovaldi (sofosbuvir), Zepatier (elbasvir/grazoprevir), Daklinza (daclatasvir) and Mavyret (glecapravir, pibrentasvir) ***(Burakoff 2020).***

2.15 Prevention

2.15.1 Prevention of HBV Infection

HBsAg-positive women who are pregnant should inform their providers, so hepatitis B immune globulin (HBIG) and hepatitis B vaccine can be administered to their newborn immediately after delivery. HBIG and concurrent hepatitis B vaccine are 95% efficacious in the prevention of perinatal transmission of HBV; the efficacy is lower (i.e., 85%) for maternal carriers with very high serum HBV DNA levels. In areas where HBIG is unavailable or in circumstances of severe maternal viremia, some studies suggest that antiviral treatment (with lamivudine and, more recently, telbivudine) during late pregnancy can safely reduce perinatal HBV transmission ***(Thomas. et al. 2014).***

The mainstay of perinatal HBV infection prevention is a combination of active and passive immunization for exposed infants. Before the development of an HBV vaccine, HBV immunoglobulin (HBIG) alone, administered within 12 hours of delivery, was shown to be effective in providing transient passive immunity, but 25% of infants became infected through household contact by 1 year of age ***(Smfm et al. 2016).***

2.15.2 Prevention of HCV Infection

Unfortunately, there is no vaccine to prevent hepatitis C. To reduce your risk of getting hepatitis C:

1. Injection drug use is the most common way people get hepatitis C. Avoid injecting drugs to reduce your risk. If you do inject drugs, use sterile injection equipment. Avoid reusing or sharing.
2. Avoid sharing personal care items that might have blood on them (razors, toothbrushes, nail clippers).
3. If you are a health care or public safety worker, follow universal blood/body fluid precautions and safely handle needles and other sharps.
4. Consider the risks if you are thinking about tattooing, body piercing, or acupuncture – are the instruments properly sterilized?
5. If you are having sex with more than one partner, use latex condoms correctly and every time to prevent the spread of sexually transmitted diseases, including hepatitis C ***(https://www.sfcdcp.org/, (2020)***.

2.16 Previous Studies

A retrospective comparative study was carried out regarding servo-prevalence of HBV and HCV among pregnant women attending the antenatal clinics of Konya Dr. Ali Kemal Beliani Gynecology and Children Hospital, Turkey, 2016. The results of this study showed that the prevalence of HBsAg and anti-HCV were 0.2% and 15.4%, respectively, while anti- HBsAg was 28.8% ***(Gündem et al. 2016).***

A retrospective study was carried out regarding investigating the prevalence of HIV, HBV, and HCV infection within an obstetric population in north India, 2015.the result of this study showed that the prevalence of HBV and HCV was 0.36% and 0.84%, respectively ***(Malhotra et al. 2015).***

A cross-sectional study was conducted regarding Hepatitis B Virus Infections and Associated Factors among Pregnant Women Attending Antenatal Care Clinic at Deder Hospital, Eastern Ethiopia, 2015. The result of this study showed that the prevalence of HBV was 6.9% ***(Umare et al. 2015).***

A cross-sectional study was conducted regarding the prevalence and factors associated with hepatitis B virus and hepatitis C virus infections among pregnant women in the Asante Akim North Municipality, in the Ashanti region of Ghana, 2015. The results of this study showed that the prevalence of HBV and HCV was 9.5 %, and 7.7 %, respectively ***(Ephraim et al. 2015).***

A study for investigating the prevalence and possible predisposing factor for hepatitis B and C viruses was conducted among pregnant women registered for antenatal care in a Rural Clinic in Northern Nigeria,2014. The results of this study showed that the prevalence of HBV was 8.7%, HCV 3.0%, and HBV-HCV co-infection was 1.0% ***(Grace et al. 2014).***

A cross-sectional study regarding investigating seropositive of hepatitis B, hepatitis C among pregnant women was conducted in central Sudan,2014. The results of this study showed that the prevalence of HBV and HCV was 5.1% and 1.3%, respectively ***(Osman et al. 2014).***

A cross-sectional study regarding the Seroepidemiology of Hepatitis B and C Virus Infections among Pregnant Women was carried out Attending Antenatal Clinic in Selected Health Facilities in East Wollega Zone, West Oromia, Ethiopia, 2014. The results of this study showed that the prevalence of HBV and HCV was 2.4%and 6.7 %, respectively ***(Dabsu et al. 2014).***

A cross-sectional study regarding the Seroprevalence of hepatitis B surface antigen and anti HCV antibody and its associated risk factors was conducted among pregnant women attending the maternity ward of Feige Hiwot Referral Hospital, northwest Ethiopia, 2014.the result of this study showed that the prevalence of HBV and HCV was 4.4 and 0.26 %, respectively ***(Molla et al. 2014).***

A Cross-sectional study regarding the frequency of hepatitis B viral markers was conducted among pregnant women attending Gynecology and Obstetrics, Military Hospital Rawalpindi,2013. The results of this study showed that the frequency of HBV was 4.69% ***(Anwar et al. 2013).***

A cross-sectional study regarding Sero-prevalence for Hepatitis B virus among pregnant women was conducted attending an antenatal clinic in Juba Teaching Hospital, Republic of South Sudan,2013. The results of this study showed that the seroprevalence of HBV was 11% ***(Kirbak et al. 2013).***

A cross-sectional study regarding the prevalence of Hepatitis B Surface Antigen (HBsAg) and its Influencing Factors was conducted in Pregnant Women Referring to Healthcare Centers care of Dehloran city, Iran, 2012. The results of this study showed that the prevalence of HBsAg was 0.59% ***(Kheiri et al. 2012).***

A cross-sectional study was carried out on the prevalence of HBV and HCV infections among pregnant women in the antenatal clinic of the University of Benin Teaching Hospital, in Nigeria,2011. The results of this study showed that the prevalence of HBV and HCV was 12.5%, and 3.6%, respectively ***(Ugbebor et al. 2011).***

A cross-sectional study was conducted on the prevalence and factors associated with hepatitis B virus infections among pregnant women in seven provinces in Iran ,2011. The results of this study showed that the prevalence of HBsAg 1.2%. and hepatitis B e-antigen 11% ***(Shoghli et al. 2011).***

A cross-sectional study regarding the prevalence of Hepatitis B Infection was conducted among pregnant women at Khartoum Teaching Hospital, Sudan,2010. The results of this study showed that the prevalence of HBV was 7.5% ***(Abuelgasim et al. 2010).***

A cross-sectional study regarding the seroprevalence of hepatitis B virus infection among was conducted antenatal clinic attendees at a tertiary hospital in Dar es Salaam, Tanzania,2010. The results of this study showed that the prevalence of HBsAg was 3.9% ***(Rashid et al. 2010).***

A cross-sectional study regarding the seroprevalence and associated risk factors for markers of HBV (hepatitis B surface antigen; HBsAg) and anti-HCV antibody was conducted among pregnant women at Al-Thawra Hospital in Sana’a, Yemen, 2013.

The results of this study showed that the prevalence of HBV and HCV was 10.8% and 8.5 %, respectively ***(Murad et al. 2013).***

A retrospective study was carried out regarding the Blood Bank Unit of the University of Science and Technology Hospital (USTH), Sana`a, Yemen, 2010. The results of this study showed that the frequencies of HBV and HCV among blood donors were 1.72% and 1.05%, respectively ***(Sultan et al. 2010).***

A cross-sectional study was conducted regarding the frequency of anti-HCV, HBsAg, and related risk factors in pregnant women at Nishtar Hospital, Multan Pakistan,2010. The results of this study showed the frequencies (7.0%) of anti-HCV positive and (4.60%) were positive for HBsAg ***(Taseer et al. 2010).***

A cross-sectional study was conducted regarding the seroprevalence of hepatitis B among pregnant women attending maternal and child health centers in Shebin El-Kom district (Menoufia governorate), Egypt,2014. The results of this study showed (2.3%) of HBV ***(El Sayed et al. 2014).***

A filed analysis study was conducted regarding the Hepatitis B virus and hepatitis C virus seroprevalence in rural areas of the southwestern region of Turkey,2007. The results of this study showed (2.5%) were HBsAg-positive, (16.2%) were anti-HBs-positive, and (1.0%) were anti-HCV-positive ***(Akcam et al.2007).***

A descriptive cross-sectional, quantitative study regarding Hepatitis B and C in pregnant women attended by a prenatal program in a University at the hospital in Rio De Janeiro, Brazil,2013. The results of this study showed HBsAg (1.9%), anti-HBs (35.9%), and anti-HCV patients (1.3%) ***(Barros et al. 2013).***

A cross-sectional study conducted regarding Open access Preliminary study of seroprevalence and risk factors for hepatitis B infection in pregnant women in Lubumbashi, Democratic Republic of the Congo, 2016. The results of this study showed that, the HBsAg positive 1.48% ***(Ngalula et al.2016).***

A cross-sectional study was conducted regarding the Sero-prevalence of hepatitis B virus and associated factors among pregnant women in Gambelia Hospital, South Western Ethiopia, 2017. The results of this study showed that HBsAg was detected by 7.9% ***(Tanga et al. 2017).***

A cross-sectional study was conducted regarding the prevalence of Hepatitis B Virus Infection and Associated Seromarkers among Pregnant Women in Eritrea, 2016. The results of this study showed that the serological markers showed (3.2%) were positive for HBsAg indicating an active infection and (3.9%) positive for HBeAg indicating increased infectivity. It was noted that (17.4%) of the HBsAg positive. ***(Nohom et al. 2016).***

A cross-sectional study was conducted regarding the pattern of hepatitis virus infection among pregnant women and their newborns at the Women's Health Center of Assiut University, Upper Egypt, 2010. The results of this study showed that 6.4% were HCV positive, 4.0% were HBV positive, and 1.0% were both ***(Zahran et al. 2010).***

A cross-sectional study conducted regarding the hepatitis B virus and hepatitis C virus in pregnant women at Omdurman Maternity Hospital in Sudan ,2007. The results of this study showed that the HBsAg was detected at 5.6%, Anti-HCV was detected in 0.6% ***(ElSheikh et, al. 2007).***

A cross-sectional study was conducted regarding Seroprevalence and correlates of HIV, syphilis, and hepatitis B and C virus among intrapartum patients in Kabul, Afghanistan, 2006. The results of this study showed that the HBsAg was 1.53% and anti-HCV was 0.31% ***(Todd et al. 2006).***

A cross-sectional study was conducted regarding the screening of pregnant Saudi women for hepatitis B surface antigen, 2004. The results of this study showed that the HBsAg was 2.6% and HBeAg was 0.15% ***(Al-Mazrou et al. 2004).***

A cross-sectional study was conducted regarding Screening Hepatitis B virus sero-prevalence among pregnant females in Saudi Arabia,2008. The results of this study showed that the HbsAg 1.6% ***(Alrowaily et al. 2008).***

A cross-sectional study was conducted regarding Hepatitis C Virus Infection during Pregnancy in Upper Egypt ,2016. The results of this study showed that HCV 1.4% ***(Edessy et al. 2016).***

A cross-sectional study was carried was regarding Seroprevalence and risk factors of hepatitis B and C infections among pregnant women, Lucknow, Uttar Pradesh, India, 2020. The result of this study showed HBsAg 5.8% were and HCV 1.7% ***(Jahan et al. 2020).***

A cross-sectional study was carried out regarding Prevalence, Infectivity, and Associated Risk Factors of Hepatitis B Virus among Pregnant Women in Yirgalem Hospital, Ethiopia, 2018. The result of this study showed that HBsAg was 7.2%, 38.8% were positives for HBeAg, and HIV infection was 10.1% ***(Amsalu et al. 2018).***

A cross-sectional study regarding Sero-prevalence for Hepatitis B virus among pregnant women was conducted on attending an antenatal clinic in Juba Teaching

Hospital, Republic of South Sudan,2013. The results of this study showed that the seroprevalence of HBV was 11% ***(Kirbak et al. 2013).***

Cross-sectional study was carried out regarding Hepatitis B virus infection amongst pregnant women in North-eastern Nigeria,2008. The results of this study showed that the Positive HBsAg (8.2%) ***(Olokoba et al. 2008).***

A cross-sectional study was carried out regarding Prevalence and Risk Factors of Hepatitis B Virus in Jazan Region, Saudi Arabia, 2009. The results of this study showed that the prevalence of HBV was (8.3%) ***(Ageely et al. 2009).***

CHAPTER THREE

OBJECTIVES OF THE STUDY

AND HYPOTHESIS

CHAPTER III: OBJECTIVES OF THE STUDY AND HYPOTHESIS

3.1 General Objective

The general objective of this study is to determine the sero-prevalence and associated risk factors of hepatitis B and C among pregnant women attending obstetrics and gynecology clinics for antenatal care in Saleh Babker Welfare Hospital Alaeen Valley, Hadhramout Governorate, Yemen.

3.2 Specific Objectives

The specific objectives of this study are as follows:

1. To calculate the sero-prevalence of hepatitis B and C viral infection among pregnant women attending obstetrics and gynecology clinic for antenatal care in Saleh Babker Welfare Hospital Alaeen Valley, Hadhramout Governorate.
2. To verify if there is an association between demographical characteristics of pregnant women and sero-prevalence of hepatitis B and C viral infection among them.
3. To identify the associated factors influencing the transmission of HBV among pregnant women in the study area.
4. To determine the associated factor influencing transmission HCV among pregnant women in the study area.
5. To examine the relationship between sero-prevalence HBV and HCV infection and associated factors.

3.3 HYPOTHESIS

1. There is no statistical significant association between the demographical characteristics of pregnant women and the sero-prevalence of hepatitis B and C viral infection.
2. There is no statistical significant association between the associated risk factors of pregnant women and the sero-prevalence of hepatitis B and C viral infection.

CHAPTER FOUR

RESEARCH METHODOLOGY

CHAPTER IV: RESEARCH METHODOLOGY

4.1. Study Design

In order to achieve the mentioned objectives, hospital-based descriptive cross-sectional study was conducted among pregnant women attending obstetrics and gynecology clinics for antenatal care in Saleh Babker Welfare Hospital, Alaeen Valley, Hadhramout Governorate, Yemen during the study period Mars-June, 2019.

4.2. Study Setting

Alaeen Valley is a valley located in the middle of the province of Hadhramout governorate, Yemen. Alaeen Valley is a part of a district called Alaeen Valley and Hurrah. It consists of 30 villages, and it covers an area of 2340 km2 with an estimated population 13,984 (Male 4,270, Female 4,920, Children 2,556) ***(Valley and Hurrah 2018)***. Alaeen Valley lies at altitude 1,033 meters above the sea level.

Saleh Babker Welfare Hospital, Alaeen Valley, Hadhramout Governorate is a welfare hospital.

About pregnant women are attending obstetrics and gynecology clinics in Saleh Babker Welfare hospital daily. Saleh Babker Welfare Hospital has 5 beds to serve pregnant women.

4.3 Study Population

Pregnant women attending obstetrics and gynecology clinic for antenatal care in Saleh Babker Welfare Hospital, Alaeen Valley, Hadhramout Governorate, Yemen, during the study period, Mars-June 2019, represented the target population of the study.

4.4 Sampling Techniques

4.4.1 Sample Size Calculation

The sample size was calculated to precisely estimate the prevalence of HBV and HCV infections.

The sample size was calculated to provide 80% power. Epical version 2000 used based on the following assumptions:

Reference population = 4.920 ***(Valley and Hurrah 2018)***.

Proportion =12%.

Precision = 4 %.

Confidence level = 95%

Calculated sample size = 253.

The sample size was increased by 19% to become 300 participants, in order to deal with refining to participating and missing data.

Estimating proportion among pregnant women in Alaeen valley, Hadhramout Governorate using the following formula.

$N= Z^2 \times P\ q / d^2$

N = sample of size needed. Z = 1.96

P = Proportion =12%. d = Precision = 4 %

Q=1-p

4.4.2 Sampling

All pregnant women that attend obstetrics and gynecology clinic in Saleh Babker Welfare Hospital, Alaeen Valley, Hadhramout Governorate, Yemen, during the study period were enrolled in the study to follow investigation for antenatal care, and they were consecutively enrolled until the desired sample size was reached. Those pregnant women who are corresponding to the inclusion criteria were included in the study and those who are corresponding to exclusion criteria were excluded from the study.

4.4.3 Inclusion Criteria

Any pregnant women attending obstetrics and gynecology clinic in Saleh Babker Welfare Hospital, Alaeen Valley, who had not been vaccinated against hepatitis B, were included.

Any pregnant women volunteers to participate in this study during the study period were also included.

4.4.4 Exclusion Criteria

Any pregnant women attending obstetrics and gynecology clinic for antenatal care in Saleh Babker Welfare Hospital, Alaeen Valley, who were vaccinated against hepatitis B virus, or volunteers who refused to participate in this study.

4.5 Data Collection Tools and Techniques

4.5.1 Face to Face Anonymous Structure Closed-End Interview

An Anonymous structured closed-end questionnaire was administered to All pregnant women attending the obstetrics and gynecology clinic in Saleh Babker Welfare Hospital, Alaeen valley. A specially designed questionnaire is derived from other published studies dealing with the same topic ***(Nahom et al. 2018;Murad et al.***

2013; Abuelgasim & Baraka 2015). The Arabic version was used. The questions are comprised of two close-ended questionnaires:

Part I: Socio-demographic data. This part contains the following:

- Age.
- Residence
- Level of education.
- Occupation
- Marital Status
- Parity

Part II: Risk factors and Medical history. This part contains the following:

- History of positive of HBV and HCV testing.
- History of blood transfusion.
- History of Liver disease among family membrane, or jaundices.
- History of surgical procedures.
- History of dental procedures.
- History of cupping procedures.
- History of ear-piercing procedures.
- History tattoo of procedures.

4.5.2 Blood Investigation

Blood samples were collected by vein puncture.5 ml of Venus Blood specimen was collected by venipuncture and put in a vacuum tube to clotting and separated by centrifuging. The whole blood at 3000 rpm for 5 minutes using 5 ml Eppendorf tubes. Separated clear serum sample was kept at 20 ^{o}C until testing for HbsAg and HCV antibodies. The test work in the laboratory of Saleh Babker welfare Hospital, Alaeen valley, Hadhramout Governorate, Yemen. The laboratory is a reference laboratory of the study area and a highly quality worker.

4.5.2.1 Blood Examination for HBsAg

By using an Enzyme-Linked Immunosorbent Assay (ELISA) serum sample was for HbsAg using ELISA kit following the manufacturer's instruction technique to detect HbsAg.

4.5.2.1 A Regents Component for HbsAg Detection:

For providing ELISA technique, we used archived serum samples from Serological kits that detect HbsAg supplied by enzyme immune assay kits (ACON Biotech (Hanzhou) Co., Ltd.No.398 Tianmushan Road, Hanzhou, P.R. China 310023 Made in China), stored at-70 ^{o}C, were allowed to thaw at room temperature.

4.5.2.1 B Materials Provided for ELISA Testing

Table 3: Regents Material for ELISA Test to Detect HbsAg

No.	Reagent	Component Description	Quantity
1	HbsAg micro well Palate	Micro well Plate Coated with Anti-HbsAg	1 Plate (96 well/plate)
2	HbsAg Conjugate	Anti-HbsAg bound to peroxidase; Preservative: 0.1%ProClin TM300	1 x 8 ml
3	Concentrated Wash Buffer (25 x)	Tris-HCL buffer containing 0.1% Tween20; Presevative:1% ProClin TM 300	1 x 40 ml
4	Substrate A	Citrate-Phosphate buffer containing hydrogen peroxide; Presevative:1% ProClin TM 300	1 x 8 ml
5	Substrate B	Buffer containing tetramethylbenzidine (TMB); Presevative:1% ProClin TM 300uired	1 x 8 ml
6	Stop Solution	0.5 M Sulfuric acid	1 x 8 ml
7	HbsAg Negative Control	Normal serum non-reactive for HbsAg, HCV, HIV-1, and HIV-2; Presevative:1% ProClin TM 300	1 x 1 ml
8	HbsAg Positive Control	Inactivated serum containing HbsAg and negative for HCV, HIV-1, HIV-2; Presevative:1% ProClin TM 300	1 x 1 ml
9	Plate Sealers		2
10	Package Insert		1

4.5.2.1 C Materials Required

1. Freshly distilled or deionized water.
2. Absorbant paper.
3. Incubator capable of maintaining $37^{O}C$ ±2.
4. Calibrated automatic or manual micro well plate washer capable of aspirating and dispensing 350 µ/well.
5. Disposable gloves.
6. Calibrated micropipettes with disposable tips capable of dispensing 50 and 100 µl.
7. Graduated cylinders for wash buffer dilution.
8. Vortex mixer for specimen mixing (optional).
9. Timer.
10. Disposable reagent reservoirs.
11. Calibrated micro plate reader capable of reading at 450 nm with a 630-700 nm reference filter.
12. Automated processor (optional).

4.5. 2.1. D Procedure for HbsAg Detection

Allow reagents and specimens to reach temperature (15-30^{o}C) prior to testing.

1. Prepare working wash buffer by diluting the concentrated wash buffer 1:25, pour the contents of the bottle containing the concentrated, wash buffer in a graduated cylinder, and fill with freshly distilled or deionized water to 1000 ml for 96 wells/plate testing, or 500 ml for 48 wells/plate testing. The working wash buffer is stable for 2 weeks at $37^{O}C$.

Note: if crystals are present in the concentrated wash buffer, warm it up at 37^{o}C until all crystals dissolve.

2. Leave A1 as Blank well.
3. Add 100µl of Negative Control in wells B1. (Blue Regent).
4. Add 100µl of Positive Control in wells C 1. (Red Regent).
5. Add 100µl of Specimen to assigned wells starting at D 1.
6. Add 50µl of the conjugate to each well except for the Blank well.
7. Mix gently by swirling the micro well plate on a flat bench for 30 seconds.
8. Cover the micro well plate with a plate sealer and incubate in an incubator at 37^{O}C ±2 for 60 minutes ±2 minutes.
9. Remove the plate sealer.
10. Wash each well 5 times with 350 µl of working wash buffer per well, then remove the liquid.
11. Tum the micro well plate upside done on absorbent tissue for a few seconds. Ensure that wells have been completely washed and dried.
12. Add 50µl of substrate A to each well (clear reagent).
13. Add 50µl of substrate B to each well (clear reagent).
14. Then a blue color should develop in wells containing positive specimens.
15. Mix gently, then cover a well plate sealer and incubate in an incubator at 37^{O}C ±2 for 10 minutes ±1 minute.
16. Remove the plate sealer.
17. Add 50µl of stop solution to each well (clear reagent).
18. Then a yellow color should develop in wells containing positive specimens.
19. Read at 450/630-700 nm within 30 minutes.

4.5.2.2 Blood Examination for HCV Antibodies

By using an Enzyme-Linked Immunosorbent Assay (ELISA) serum sample was used for HCV antibodies. Using an ELISA kit following the manufacturer's instruction technique to detect HCV antibodies.

4.5.2.2 A Regents Component for HCV Antibodies Detection

For providing ELISA technique, we used archived serum samples from Serological kits that detect HCV antibodies. Supplied by enzyme immune assay kits (ACON Biotech (Hanzhou) Co., Ltd.No.398 Tianmushan Road, Hanzhou, P.R. China 310023 Made in China), stored at-70 ^{o}C, were allowed to thaw at room temperature.

4.5.2.2 B Materials Provided for ELISA Testing

Table4: Regents Material for ELISA Test to Detect anti HCV

No.	Reagent	Component Description	Quantity
1	HCV micro well Palate	Micro well Plate coated with recombinant HCV antigens	1 Plate (96 well/plate)
2	HCV Conjugate	Anti-human IgG antibody bound to peroxidase; Preservative: 0.1%ProClin ™300	1 x 12 ml
3	Concentrated Wash Buffer (25 x)	Tris-HCL buffer containing 0.1% Tween20; Presevative:1% ProClin ™ 300	1 x 50 ml
4	Specimen Diluent	Tris buffer containing Presevative:1% ProClin ™ 300	1 x 12 ml
5	Substrate A	Citrate-Phosphate buffer containing hydrogen peroxide; Presevative:1% ProClin ™ 300	1 x 8 ml
6	Substrate B	Buffer containing tetramethylbenzidine (TMB); Presevative:1% ProClin ™ 300uired	1 x 8 ml
7	Stop Solution	0.5 M Sulfuric acid	1 x 8 ml
8	HCV Negative Control	Normal serum non-reactive for HCV, HbsAg, HIV-1, and HIV-2; Presevative:1% ProClin ™ 300	1 x 0.4 ml
9	HbsAg Positive Control	Inactivated serum containing antibodies to HCV and negative for, HbsAg HIV-1, HIV-2; Presevative:1% ProClin ™ 300	1 x 0.4 ml
10	Plate Sealers		3
11	Package Insert		1

4.5.2.2. C Materials Required

1. Freshly distilled or deionized water.
2. Absorbent paper.
3. Incubator capable of maintaining $37^{O}C$ ±2.
4. Calibrated automatic or manual micro well plate washer capable of aspirating and dispensing 350 µ/well.
5. Disposable gloves.
6. Calibrated micropipettes with disposable tips capable of dispensing 50 and 100 µl.
7. Graduated cylinders for wash buffer dilution.
8. Vortex mixer for specimen mixing (optional).
9. Timer.
10. Disposable reagent reservoirs.
11. Calibrated microplate reader capable of reading at 450 nm with a 630-700 nm reference filter.
12. Automated processor (optional).

4.5.2.2. D Procedure for HCV Antibodies Detection

Allow reagents and specimens to reach temperature (15-30^{o}C) prior to testing.

1. Prepare working wash buffer by diluting the concentrated wash buffer 1:25, pour the contents of the bottle containing the concentrated, wash buffer in a graduated cylinder, and fill with freshly distilled or deionized water to 1000 ml for 96 wells/plate testing, or 500 ml for 48 wells/plate testing. The working wash buffer is stable for 2 weeks at $37^{O}C$.

   Note: if crystals are present in the concentrated wash buffer, warm it up at 37^{o}C until all crystals dissolve.

2. leave A1 as Blank well
3. Add 100µl of Specimen Diluent in respective wells including Negative Control, Positive Control, Blank, and specimen wells (Green Reagent).
4. Add 10µl of Negative Control in wells B1. (Blue Reagent).
5. Add 10µl of Positive Control in wells C 1. (Red Reagent).
6. Add 10µl of Specimen to assigned wells starting at D 1.
7. Mix gently by swirling the micro will plate on a flat bench for 30 seconds.
8. Cover the micro well plate with a plate sealer and incubate in an incubator at $37^{O}C$ ±2 for 30 minutes ±2 minutes.
9. Remove the plate sealer.
10. Wash each well 5 times with 350 µl of working wash buffer per well, then remove the liquid.
11. Tum the micro well plate upside done on absorbent tissue for a few seconds. Ensure that wells have been completely washed and dried.
12. Add 100 µl of the conjugate to each well except for the blank well. (Red reagent).
13. Cover the micro well plate with a plate sealer and incubate in an incubator at $37^{O}C$ ±2 for 30 minutes ±2 minutes.
14. Remove the plate sealer.
15. Wash each well 5 times with 350 µl of working wash buffer per well, then remove the liquid.
16. Tum the micro well plate upside done on absorbent tissue for a few seconds. Ensure that wells have been completely washed and dried
17. Add 50µl of substrate A to each well (clear reagent).
18. Add 50µl of substrate B to each well (clear reagent).

19. Then a blue color should develop in wells containing positive specimens.
20. Mix gently, then cover a well plate sealer and incubate in an incubator at $37^{O}C$ ±2 for 10 minutes ±1 minute.
21. Remove the plate sealer.
22. Add 50µl of stop solution to each well (clear reagent).
23. Then a yellow color should develop in wells containing positive specimens.
24. Read at 450/630-700 nm within 30 minutes.

4.6 Variables

4.6.1 Socio-Demographic Data

- Age.
- Residence.
- Level of education.
- Occupation.
- Marital status.
- Parity.

4.6.2 Risk Factors and Medical History

- History of positive of HBV and HCV testing.
- History of blood transfusion.
- History of liver disease among family membrane, or jaundices.
- History of surgical procedures.
- History of dental procedures.
- History of cupping procedures.
- History of ear-piercing procedures.
- History tattoo of procedures.

4.7 The Validity of the Tool

The questionnaire was adapted from previously validated and reliable studies and the Arabic version of the questionnaire was reviewed by three experts in order to determine if all questions were worded and would not be misinterpreted. As a result, some questions were omitted, some added and others rephrased. Other questions added were formulated by the researcher with the help of a literature supervisor and experts were made modifications to add, or omit to clarify and correct misinterpreted and doubtlessness from credence and completeness of study tools.

4.8 Reliability of the Tool

In general, reliability means the degree to which an instrument measures the same way each time it is used under the same condition with the same subjects. There are many methods in which it can be measured in order to ascertain the extent of the reliability to measure what it was designed for, but in this study, the Cronbach's Alpha internal consistany reliability of the questionnaire was tested, the tool was found to be highly reliable for data collection coefficient was (0.79).

4.9 Pilot Study

The piloted sample of the questionnaire was performed before data collection. A pilot study was done on 10% of the calculated sample size on items in a questionnaire to assess the clarity and feasibility of the study, and drawbacks of the questionnaire. Following the pilot study, minimal modifications to the layout and presentation of the instrument were made.

4.10 Data Processing and Statistical Analysis

Once the questionnaires were collected, a codebook was developed to provide numerical results for analysis. All available data organized into tables and figures. Cross-tables were used to provide an overall and coherent presentation and description of data.

Data cleaning and validation were done before analysis. A packaged computer analysis program, the Statistical Package for the Social Science (SPSS 21) was used for statistical analysis of this data. Descriptive analysis was carried out by calculating the mean age and the standard deviation: Socio-demographic data, residence, level of education, occupation, marital state, parity,

The likelihood -ratio Chi-square test of statistical significance was used to determine any association between HBV and HCV infection and various exposure variables. The risk factor variable with P-value ≤ 0.05 was considered significantly associated with HBV and HCV infection.

The Cronbach's Alpha was used to test internal consistany of questionnaire.

4.11 Ethical Considerations

The ethical clearance for the study was obtained from the Ethics Committee of Al-Razi University before the start of the fieldwork (Appendix 1 & Appendix 2). The institutional approval from the health administration of the hospital was obtained. The study objectives and procedures were explained by all participants and to the hospital staff team- Informed consent or verbal consent from alliterated pregnant women.

Agreement was obtained from each study participant. Participation in the study is completely voluntary, any participant has the right to withdraw from the study at any

time without any negative impact on her health services. The confidentiality of the gathered information was assured.

CHAPTER FIVE

RESULTS

CHAPTER V: RESULTS

By the end of the study, a total of 300 pregnant women attending obstetrics and gynecology clinics for antenatal care were recruited in this study in Saleh Babker Welfare Hospital, Alaeen Valley, Hadhramout Governorate, Yemen during the study period Mars - June 2019. The response rate of the study was (100%).

Of 300 pregnant women who participated in the current study, 9 (3%) pregnant women had positive HbsAg and 2 (0.7%) had positive HCV antibodies. The overall seroprevalence of HBV and HCV infection among participated pregnant women attending obstetrics and gynecology clinics for antenatal care in Saleh Babker Welfare Hospital, Alaeen Valley was 3% and 0.7%, respectively.

5.1 Demographic Characteristics of Study Participants

5.1.1 Distribution of Target Participants According to Age

According to age, the results of the study showed that the youngest age noted during the study period for enrolled pregnant women was about 17 years and a maximum of about 45 years with mean ± SD, 29.37± 6.572 years old. For more details, see table No. 5 and figure No. 7

Table 5: Distribution of Target Participants According to Age (N=300)

	N	Minimum	Maximum	Mean	Std. Deviation
Age	300	17	45	29.37	6.572

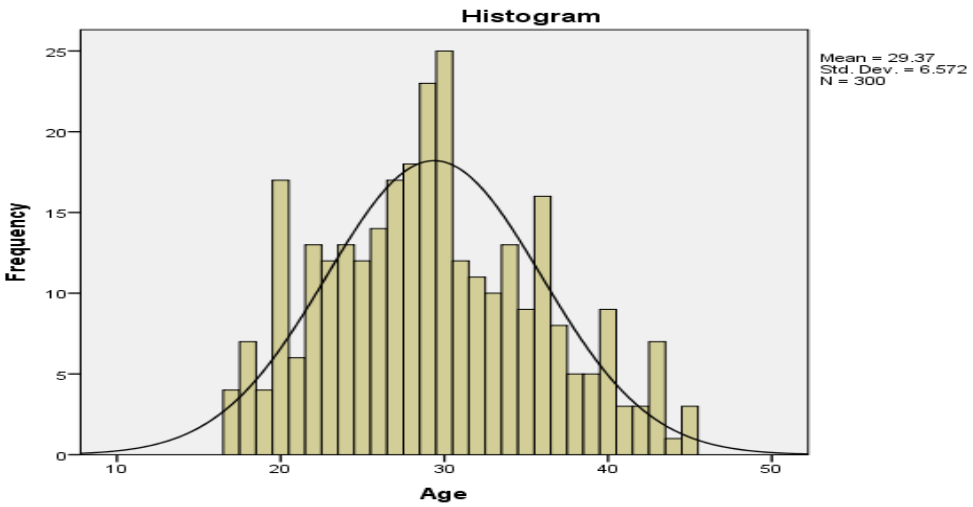

Figure 7: Distribution of Target Participants According to Age (N=300)

5.1.2 Distribution of Participants According to Residence

Results of the current study showed that more than two-thirds (70%) of pregnant women were from semi-urban area, while (30%) of the participants were from the urban area, as shown in Table No 6.

5.1.3 Distribution of Participants According to Educational Level

Results of the current study showed that more than half (51%) of pregnant women who participated in the current study had basic education, while (27%) were illiterate, (19%) were secondary school education level and 3% were. graduated. The results are illustrated in table No. 6

5.1.4 Distribution of Participants According to Occupation

Most of the pregnant women (83%) who enrolled in the current study were housewives, while others (17%) worked as agricultural workers. See table No. 6.

5.1.5 Distribution of Participants According to Marital Status

The vast majority of the participants (94%) were married, while the separated were about (6%). as shown in Table No 6.

5.1.6 Distribution of Participants According to Parity

The vast majority (72%) of the pregnant women attending obstetrics and gynecology clinics for antenatal care and enrolled in the study during the study period in Saleh Babker Welfare Hospital, Alaeen Valley were multigravida**,** while primary gravida was (28%) as shown in Table No 6.

Table 6: Demographic Characteristics of Participants (N=300)

Demographic Data		F	%
Age group (in years)	• 17-26	185	62
	• 27-36	98	32
	• 37 and above	17	6
Residence	• Semi Urban	210	70
	• Urban	90	30
Education	• Illiterate	81	27
	• Basic	153	51
	• Secondary	57	19
	• Undergraduate	9	3
Occupation	• Housewife	249	83
	• Worker	51	17
Material Status	• Married	283	94.3
	• Separate	17	5.7
Parity	• Primary gravida	84	28
	• Multi gravida	216	72

5. 2 Distribution of the Participants According to Risk Factors and Medical History

Table 7 shows the distribution of the sample according to risk factors and medical history of the participants in the study of pregnant women. The results of the study showed that all those who participated in the study, pregnant women (100%) did not have taken vaccination for HBV were not tested for HBV&HCV, and there was no history of tattoo. While only about (12%) of those who participated. pregnant women had a history of blood transfusion. Only (17%) of those who participated. pregnant women had a history of surgery. Only (2%) of the participating pregnant women had both histories of liver diseases and history of cupping. Also, more than half (63.3%) of the participating pregnant women had a history of dental management, and about (100%) of them had ear piercing. For more details, see table No 7.

Table 7: Distribution of Participants According to Risk Factors and Medical History (N=300).

Risk factor & Medical history		Responses			
		Yes		No	
		F	%	F	%
• Past test for HBV&HCV		0	0	300	100
• Blood Transfusion		36	12	264	88
• Time transfusion	1. Months	6	2	264	88
	2. Years	30	10		
• History of liver diseases		6	2	294	98
• History of surgery		51	17	249	83
• Types of surgery	1. Cistercian surgery	14	4.7	249	83
	2. Others	37	12.3		
• History of dental management		190	63.3	110	36.7
• Site of dental management	1. In dental Clinical	157	52.3	110	36.7
	2. Out Clinical	33	11		
• Cupping		6	2	294	98
• Number of cupping	1. One	3	1	294	98
	2. Twice	2	0.7		
	3. Three	1	0.3		
• Tattoo		0	0	300	100
• Ear Piercing		300	100	0	0

5.3 Sero-prevalence of Viral Hepatitis B Infection According to Demographical Characteristics of the Participants

5. 3.1 Sero-prevalence of Viral Hepatitis B Infection According to Age of the Participants

The results of the current study showed that positive HBsAg was about (29.4%) among the enrolled in the study pregnant women in the age group 37 years and above, while positive HBsAg was (1.6%) and (1%) among the participating pregnant women in the age group 17-26 and 27-36, respectively. The results are illustrated in table No.8.

5. 3.2 Sero-prevalence of Viral Hepatitis B Infection According to Residence

The results of the current study showed that about (3.3%) were positive for HBsAg among the participating pregnant women who were from the semi-urban area, while it was (2.2%) among pregnant women who were from the urban area. The results are illustrated in table No. 8.

5.3.3 Sero-prevalence of Viral Hepatitis B Infection According to Education Level

Regarding the educational level of the participants in the study pregnant women, those pregnant women with secondary school level showed that positive HBsAg was (5.3%), while it was (1.2%), (3.3%), and (0%) among the pregnant women with illiterate, basic, and undergraduate educational level, respectively. The results are shown in table No 8.

5.3.4 Sero-prevalence of Viral Hepatitis B Infection According to Occupation

The results of this study showed that positive HBsAg was (3.2%) among the pregnant women who enrolled in the study and their occupations were housewives, while the other pregnant, women who worked as agricultural workers were (2%). The results are shown in table No 8.

5.3.5 Sero-prevalence of Viral Hepatitis B Infection According to Marital Status

According to the marital status, the current study found that positive HBsAg was (5.9%) among the separated pregnant women who participated in the study, while it was (2.8%) among the married. Details are illustrated in table No. 8.

5.3.6 Sero-prevalence of Viral Hepatitis B Infection According to Parity

About (3.2%) of multigravida participating in pregnant women revealed positive HBsAg, while positive HBsAg among the participating primary gravida pregnant women was (2.4%). More details on the demographical characteristics of pregnant women who participated in the study are illustrated in table No. 8.

Table 8: Sero-prevalence of Viral Hepatitis B Infection According to Demographical Characteristics (N=300)

Items		HbsAg			
		Positive		Negative	
		F	%	F	%
Age group (in years)	• 17-26	3	1.6	182	98.4
	• 27-36	1	1	97	99
	• 37 and above	5	29.4	12	70.6
Residence	• Semi-Urban	7	3.3	203	96.7
	• Urban	2	2.2	88	97.8
Education	• Illiterate	1	1.2	80	98.8
	• Basic	5	3.3	148	96.7
	• Secondary	3	5.3	54	94.7
	• Undergraduate	0	0	9	100
Occupation	• Housewives	8	3.2	241	96.8
	• Worker	1	2	50	98
Marital Status	• Married	8	2.8	275	97.2
	• Separate	1	5.9	16	94.1
Parity	• Primary gravida	2	2.4	82	97.6
	• Multi gravida	7	3.2	209	96.8

5.4 Sero-prevalence of Viral Hepatitis C Infection According to Demographical Characteristics of the Participants

5.4.1 Sero-prevalence of Viral Hepatitis C Infection According to Age of the Participants

The results of the current study showed that positive Anti HCV was about (2%) among the enrolled in the study pregnant women in the age group 27-36 years. The results are illustrated in table No. 9.

5.4.2 Sero-prevalence of Viral Hepatitis C Infection According to Residence

The results of the current study showed that about (1.1%) were positive for Anti HCV among the participating pregnant women who were from the urban area, while it was (0.5%) among pregnant women who were from the semi- urban area. The results are illustrated in table No. 9.

5.4.3 Sero-prevalence of Viral Hepatitis C Infection According to Education Level

Regarding the educational level of the participants in the study pregnant women, those pregnant women with illiterate showed that positive Anti HCV was (1.2%), while it was (0.7%), among the pregnant women with basic educational level. The results are shown in table No 9.

5.4.4 Sero-prevalence of Viral Hepatitis C Infection According to Occupation

The results of this study showed that positive Anti HCV was (0.8%) among the pregnant women who enrolled in the study and their occupations were housewives. The results are shown in table No 9.

5.4.5 Sero-prevalence of Viral Hepatitis C Infection According to Marital Status

According to the marital status, the current study found that positive Anti HCV was (0.7%) among the married pregnant women who participated in the study, Details are illustrated in table No.9.

5.4.6 Sero-prevalence of Viral Hepatitis C Infection According to Parity

About (1.2%) of Prmigravida participating in pregnant women revealed positive Anti HCV, while positive Anti HCV among the participating multigravida pregnant women was (0.5%). More details on the demographical characteristics of pregnant women who participated in the study are illustrated in table No. 9.

Table 9: Sero-prevalence of Viral Hepatitis C Infection According to Demographical Characteristics (N=300)

Items		HCV			
		Positive		Negative	
		F	%	F	%
Age group (in years)	• 17-26	0	0	185	100
	• 27-36	2	2	96	98
	• 37 and above	0	0	17	100
Residence	• Semi-Urban	1	0.5	209	99.5
	• Urban	1	1.1	89	98.9
Education	• Illiterate	1	1.2	80	98.8
	• Basic	1	0.7	152	99.3
	• Secondary	0	0	57	100
	• Undergraduate	0	0	9	100
Occupation	• Housewife	2	0.8	247	99.2
	• Worker	0	0	51	100
Marital Status	• Married	2	0.7	281	99.3
	• Separate	0	0	17	100
Parity	• Primary gravida	1	1.2	83	98.8
	• Multi gravida	1	0.5	215	99.5

5.5 Sero-prevalence of Viral Hepatitis B Infection According to Risk Factors and Medical History

The results of the current study showed that all participants in pregnant women (100%) had not taken vaccination for HBV, not been tested for HBV, and did not had have a history of tattoo. The results of the current study showed that the positive seroprevalence of viral hepatitis B was about (8%) among the participating pregnant women who had a history of blood transfusion, and (3.9%) of the positive seroprevalence of viral hepatitis B among the pregnant woman who had a history of surgery, more than half (66.7%) of the positive seroprevalence of viral hepatitis B among the pregnant woman who had history of liver diseases. The positive seroprevalence of viral hepatitis B (3.2%) found among the participating pregnant women had a history of dental management. The positive seroprevalence of viral hepatitis B (3.1%) found among the participating pregnant women had a history cupping, in finely, the positive prevalence of hepatitis B (3%) among the participating pregnant women who had ear piercing. For more details, see table No. 10

Table 10: Sero-prevalence of Viral Hepatitis B Infection According to Risk Factors and Medical History (N=300)

Items	Responses	HbsAg			
		Positive		Negative	
		F	%	F	%
Past Test for HBV&HCV	• Yes	0	0	0	0
	• No	9	3	291	92
Blood Transfusion	• Yes	3	8	33	100
	• No	6	2.3	258	97.7
Time Transfusion	• Months	0	0	6	90
	• Years	3	10	27	97
History of liver diseases	• Yes	4	66.7	2	33.3
	• No	5	1.7	289	98.3
History of surgery	• Yes	2	3.9	49	96.1
	• No	7	2.8	242	97.2
Type of surgery	• Caesarian	0	0	14	100
	• Others	2	5.4	35	94.6
History of dental management	• Yes	6	3.2	184	96.8
	• No	3	2.7	107	97.3
Site of dental management	• In dental Clinical	4	2.5	153	97.5
	• Out Clinical	2	6.1	31	93.9
Cupping	• Yes	0	0	6	100
	• No	9	3.1	285	96.9
Number of Cupping	• Once	0	0	3	100
	• Tawnies	0	0	2	100
	• Three	0	0	1	100
Ear Piercing	• Yes	9	3	291	97
	• No	0	0	0	0
Time of Ear Piercing	• Years	9	3	291	97

5.6 Sero-prevalence of Viral Hepatitis C Infection According to Risk Factors and Medical History

The results of the current study found that all the participating pregnant women (100%) were not tested for HCV and the history of the tattoo was not mentioned. The results of the present study showed that the positive sero-prevalence of viral hepatitis C was (2.8%) among the participating pregnant women who had a history of blood transfusion. and (2%) of the positive seroprevalence of viral hepatitis C among the pregnant woman who had a history of surgery, the positive sero-prevalence of hepatitis C was found to be (1.1%) among the participating pregnant women who had a history of dental management, and in finely the positive sero-prevalence of hepatitis C was found to be (0.7%) of the participating pregnant women had both histories of liver diseases and history ear piercing. More details are illustrated in table No.11

Table 11: Sero-prevalence of Viral Hepatitis C Infection According to Risk Factors and Medical History (N=300)

Items	Responses	HCV			
		Positive		Negative	
		F	%	F	%
Past test for HBV&HCV	• Yes	0	0	0	0
	• No	2	0.7	298	99.3
Blood Transfusion	• Yes	1	2.8	35	97.2
	• No	1	0.4	263	99.6
Time Transfusion	• Months	0	0	6	100
	• Years	1	3.3	29	96.7
History of liver diseases	• Yes	0	0	6	100
	• No	2	0.7	292	99.3
History of surgery	• Yes	1	2	50	98
	• No	1	0.4	248	99.6
Type of surgery	• Caesarian	1	7.1	13	92.9
	• Others	0	0	37	100
History of dental management	• Yes	2	1.1	188	98.9
	• No	0	0	110	100
Site of dental management	• dental Clinical	1	0.6	156	99.4
	• Out Clinical	1	3	32	99
Cupping	• Yes	0	0	6	100
	• No	2	0.7	292	99.3
Number of Cupping	• Once	0	0	3	100
	• twice	0	0	2	100
	• Three	0	0	1	100
Ear Piercing	• Yes	2	0.7	298	99.3
	• No	0	0	0	0
Time Ear Piercing	• Years	2	0.7	298	99.3

5.7 Overall Sero-prevalence of Viral Hepatitis B Infection

The majority (97%) of participating pregnant women in this study revealed negative results, while about (3%) of the participating revealed positive seroprevalence for viral hepatitis B infection as shown in figure No. 8

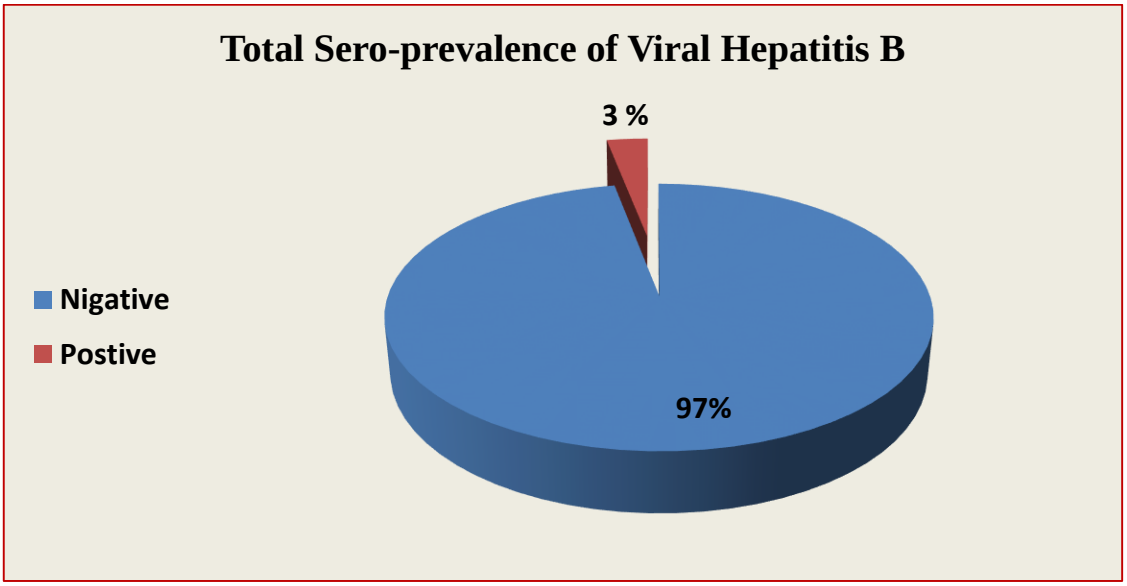

Figure 8: Overall Sero-prevalence of Viral Hepatitis B Infections (N= 300).

5.8 Overall Sero-prevalence of Viral Hepatitis C Infection

Figure 9 reveals the distribution of total positive sero-prevalence for viral hepatitis C infections among the participating pregnant women. The majority (99.3%) of the participating pregnant women had negative results for viral hepatitis C, while about (0.7%) of them had positive sero-prevalence for viral hepatitis C infections.

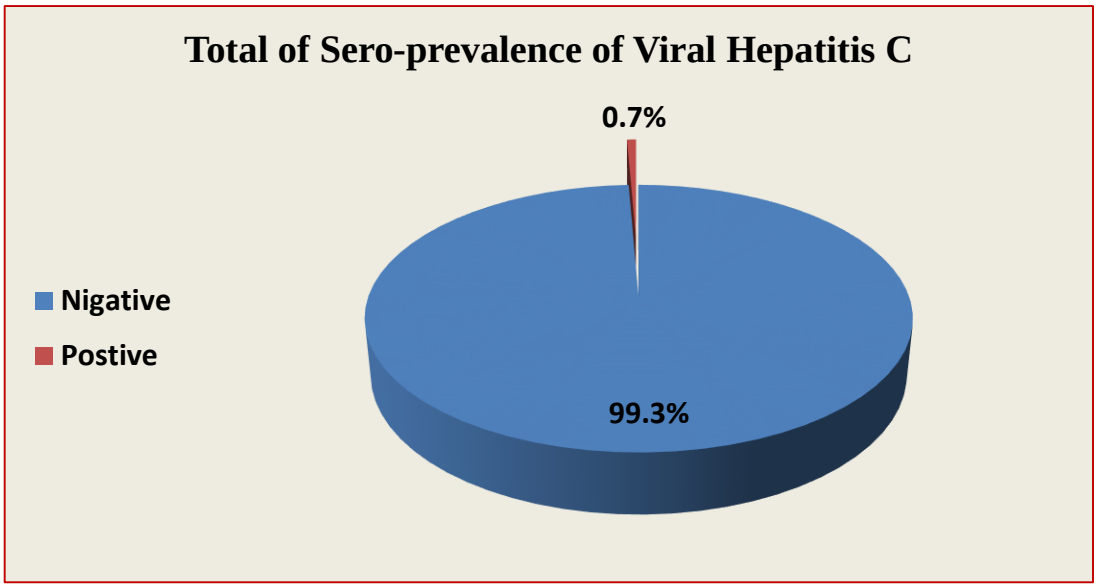

Figure 9: Total of Sero-prevalence of Viral Hepatitis C Infections (N= 300).

5.9 Association between the Overall Sero-prevalence of Viral Hepatitis B & C Infections and the Age participants

There was no statistically significant association between the overall prevalence of viral hepatitis (B and C) infections and the age of the participants of pregnant women. For more details; test: df; P>0.05, test: df; P>0.53 respectively. See table No.12

Table 12: Association between the Total Prevalence of Hepatitis B&C Viral Infections and the Age Participants (N=300)

	Hepatitis virus	Responses	N	Mean	Std. Deviation	P-value
Age	**HBsAg**	Positive	9	28.33	5.025	0.63
		Negative	291	29.40	6.619	
	HCV	Positive	2	33	1.414	0.43
		Negative	298	29.35	6.587	

5.10 Association between the Overall Sero-prevalence of Viral Hepatitis B & C Infections and Demographic Characteristics of Participants.

Table 13 shows there was no statistically significant association between the overall seroprevalence of viral hepatitis B and C infections and the demographic characteristics of the pregnant women who participated in the current study, as shown in Table No 13.

Table 13: Association between the Overall Seroprevalence of Viral Hepatitis B & C Infections and Demographic Characteristics of Participants (N=300)

Items		HbsAg		p-value	HCV		p-value
		Positive	Negative		Positive	Negative	
		F	F		F	F	
Residence	Semi-Urban	7	203	0.60	1	209	0.53
	Urban	2	88		1	89	
Education	Illiterate	1	80	0.53	1	80	0.84
	Basic	5	148		1	152	
	Secondary	3	54		0	57	
	Undergraduate	0	9		0	9	
Occupation	Housewife	8	241	0.63	2	247	0.52
	Worker	1	50		0	51	
Marital Status	Married	8	275	0.47	2	281	0.72
	Separate	1	16		0	17	
Parity	Primary gravida	2	82	0.69	1	83	0.48
	Multi gravida	7	209		1	215	

5.11 Association between the Overall Sero-prevalence of Viral Hepatitis B & C Infections and Risk Factors

There was a higher statistically significant association between the overall prevalence of hepatitis B viral infections and the medical history of liver diseases of the participating pregnant women at level (P-value= 0.000). But not statically for hepatitis C viral infections. Also there was a statistically significant association with blood transfusion for hepatitis B viral infections at level (P-value= 0.04). But not statically for hepatitis C viral infections. There was no statistically significant association between the overall prevalence of hepatitis, B and C infections, and other risk factors of the participating pregnant women. See table No 14.

Table 14: Association between the Overall Sero-prevalence of Hepatitis Viral infection and Risk Factors (N=300)

Items	Responses	HbsAg		p-value	HCV		p-value
		Positive	Negative		Positive	Negative	
		F	F		F	F	
Blood Transfusion	Yes	3	33	**0.04**	1	35	0.09
	No	6	258		1	263	
History of liver diseases	Yes	4	2	**0.000**	0	6	0.83
	No	5	289		2	292	
History of surgery	Yes	2	49	0.67	1	50	0.21
	No	7	242		1	248	
History of dental management	Yes	6	184	0.83	2	188	0.28
	No	3	107		0	110	
Cupping	Yes	0	6	0.66	0	6	0.83
	No	9	285		2	292	
Number of cupping	Once	0	3	0.99	0	3	0.97
	Twice	0	2		0	2	
	Three	0	1		0	1	

CHAPTER SIX

DISCUSSION

CHAPTER VI: DISCUSSION

Hepatitis B and hepatitis C viruses are major public health problems worldwide, affecting billions of people globally with the maternal-fetal transmission ***(WHO .2016).***

Estimates the burden of Hepatitis B virus (HBV) infection at 2 billion, with more than 240 million patients developing a chronic infection ***(Tecle et al. 2018).***

HCV is also a global health problem that affects about 200 million people worldwide, 3% of the world population living with chronic hepatitis C, while about 3-4 million people were infected every year, and about 350,000 people die every year due to HCV ***(Rubina et al. 2016)***.

HBV and HCV are the most common cause of hepatic dysfunction among pregnant women ***(Esan et al. 2014)*** with an increased risk for complication especially, as this state leaves them with a depressed immunity ***(Murad et al. 2013; Kolawole et al. 2012; Oluboyo et al. 2014)***.

There is a great difference in the prevalence of HBV between developed and developing countries as it varies between 2% in developed countries to about 8% in developing countries where the infection is endemic with sex, age, and socioeconomic status as important risk factors for infection ***(Odusanya et al. 2005).***

HBV infection during pregnancy is closely related to high risks of maternal complications including pre-eclampsia, placenta praevia, preterm delivery, placental separation, antepartum hemorrhage, and preterm labor, increased incidence of intraventricular hemorrhage, gestational diabetes mellitus, and mortality with a high rate of vertical transmission leading to fetal and neonatal hepatitis ***(Tanga et al. 2019)***.

The prevalence of HBV & HCV infection shows great variability in different parts of the world.

A few studies have been done in Yemen, but data on sero-prevalence and associated factors of viral hepatitis B and C infections among pregnant women in the study area still unknown.

Generally, the cross-sectional descriptive survey studied a total of 300 pregnant women attending obstetrics and gynecology clinics for antenatal care in Saleh Babker Welfare Hospital, Alaeen valley, Hadhramout Governorate, Yemen to determine the prevalence of HBV and HCV infections and associated risk factors among them.

This chapter presents the major findings of the study and discusses them concerning similar studies conducted by other researchers; This helped the investigator to prove that the findings were true about seroprevalence and associated factors of Viral Hepatitis B and C infections.

The results of the current study found that the mean age of the participating pregnant women was mean ± SD, 29.37± 6.572 years. This result was dose to what was reported by Ngalula et al. who reported that the mean age of pregnant women was 30.0 ± 5.34 years ***(Ngalula et al. 2018)***, in the Democratic Republic of the Congo. Regarding residence (30%) of the participants were from the urban area. This result is contrary to the report done by Tanga, who reported that (94.5%) of the participants were from the urban residence in South-Western Ethiopia ***(Tanga et al. 2019).***

The current study revealed that the majority (94.3%) of participating pregnant women were married and this finding is close to Nahom Fessehaye's findings, who reported that more than 90% of the participants were married ***(Nahom et al. 2018).***

In the present study, the researcher found the total (100%) of the participating pregnant women were had not a medical history of taken vaccination for HBV, were not tested for HBV & HCV, and there was no history of tattoo. While only about (12%) of those who participated. pregnant women had a history of blood transfusion. Only (17%) of those who participated. pregnant women had a history of surgery. Only (2%) of the participating pregnant women had both histories of liver diseases and history of cupping. Also, more than half (63.3%) of the participating pregnant women had a history of dental management, and about (100%) of them had ear piercing.

In the current study, the researcher found that the overall prevalence of HBsAg and anti HCV were (3%) and (0.7%) respectively among the participating pregnant women, which is lower than the earlier reported in Sana'a, Yemen by Murad, et al. (10.8%) HBsAg anti HCV (8.5%) ***(Murad et al. 2013).*** This difference in the findings between the studies could be due to a lack of awareness, low socioeconomic conditions, an unhygienic environment, and differences in the geographical distribution among the different directorates in the country.

The recent findings of the overall prevalence of HBsAg was (3%) lower than the findings reported in other countries: In Saudi Arabia (4.1%) ***(Bani et al. 2012)***, in Egypt (4%) ***(Zahran et al. 2010),*** in Pakistan (4.6%) ***(Taseer et al. 2010)***, in Sudan (5.6%) ***(Elsheikh et al. 2007),*** while the overall prevalence of HBsAg of the current study was higher than that in Afghanistan (1.5%) ***(Todd et al. 2008)*** and slightly higher than that in Saudi Arabia (2.6%), (1.6%) ***(Al-Mazrou et al. 2004)*** and ***(Alrowaily et al. s2008),*** in Turkey (2.8%) ***(Altinbas et al. 2010).*** It should also be appreciated though that the seroprevalence of HBsAg of (3%), as reported in the present study, is regarded as being of a moderate level of HBV infection as per the WHO classification of assessing the severity of HBsAg infection in HBV endemic countries. Countries are

classified as having low endemic rates (<2%), intermediate endemic rates (2-8%), or high endemic rates (>8%) positive for HBsAg ***(Sharma et al. 2011).***

The overall sero-prevalence of Anti HCV of the present study was (0.7%). This observation was in disagreement with the findings of the studies conducted in Pakistan (7%) ***(Taseer et al. 2010),*** in Egypt (6.4%) and (1.4%) ***(Zahran et al. 2010)*** and ***((Edessy et al. 2016)***, in Turkey (1%) ***(Altinbas et al. 2010),*** while it was slightly higher than the findings reported by authors: in Sudan (0.6%) ***(Elsheikh et al. 2007),*** in Afghanistan (0.3%) ***(Todd et al. 2008)*** and in Lorestan (West of Iran) and Ahvaz (0.2%) ***(Mohebbi et al. 2012)***. These inconsistencies could be attributed to the differences in the sample size. In addition, Mohebbi et al. conducted their study across multiple centers in rural and urban communities, whereas this single-center study was conducted in a predominantly urban and semi-urban community.

Regarding the overall sero-prevalence of HBsAg according to demographic characteristics, the current study revealed the following results: The age group 37 years and above had the highest positive HBsAg (29.4%), the positive HBsAg among semi-urban pregnant women was (3.3%), pregnant women with secondary educational level showed the highest positive HBsAg (5.3%). These findings were in disagreement with the study conducted by Tanga who found, that the highest seroprevalence of HBsAg (7.69%) was found among the pregnant women in the age group 21-25 years, and the highest sero-prevalence of HBsAg (15%) was found among the respondents with primary education ***(Tanga et al. 2019)***.

Regarding the overall sero-prevalence of anti HCV according to demographic characteristics, the current study found the following results: (2%) of the age group 27-36 years had the highest positive anti HCV, (1.1%) of the participating pregnant women

who are from the urban area had the highest positive anti HCV, (1.2%) of illiterate pregnant women had the highest positive anti HCV, and (1.2%) of the primary gravida pregnant women had highest positive anti HCV. The mentioned findings of the current study related to the positive sero-prevalence of anti HCV according to demographic characteristics were lower than the findings reported from Egypt by Mahmoud Edessy et al. as follows: The age group 30-39 years of pregnant women showed a high seroprevalence of anti-HCV (50%), the pregnant women from the rural area revealed high seroprevalence of anti-HCV too (45.5%), multigravida showed a high sero-prevalence of anti HCV (75%) ***(Edessy et al. 2016).***

Several risk factors for contracting hepatitis B and C virus infection were evaluated during the study period. The current study showed that socio-demographic variables like age, residence, educational, occupation, marital status, and parity of the participating pregnant women, were not significantly associated with the risk of HBV and HCV infections. This finding is in line with the studies conducted in Ethiopia ***(Molla et al. 2015)***, Nigeria ***(Rabiu et al. 2010*)*,*** and India ***(Gulnaz et al. 2020).***

Regarding the associated risk factors for HBV and HCV infection, the current study observed that the participating pregnant women having a previous history of blood transfusion in which (8%) and (2.8%) were positive with hepatitis B and anti HCV, respectively. This result was in disagreement with the previous report which was reported by Murad, which documented a higher sero-prevalence of HBsAg (23.3%) and (41.2%) positive anti HCV among the pregnant women who have had a history of blood transfusion ***(Murad et al. 2013).***

The present study showed that the participating pregnant women who had a history of surgery in which (3.9%) and (2%) positive with hepatitis B and anti HCV,

respectively, while Murad reported a higher sero-prevalence of HBsAg (30.2%) and (47.1%) positive anti HCV, among the pregnant women who had a history of surgery ***(Murad et al. 2013).***

In Upper Egypt, Mahmoud Edessy, et al., found that the prevalence of HCV infection among the pregnant women was associated with a history of blood transfusion, and a history of surgery (75%) and (25%), respectively. ***(Edessy et al. 2016).***

History of dental procedures is considered as another risk factor for acquiring HBV and HCV infection. The current study observed that the pregnant women having a previous history of dental procedures in which (3.2%) and (1,1%) positive with HBsAg and anti HCV, respectively. This result was far from and in disagreement with the finding reported by Murad, (76.8%) positive HBsAg and (82.4%) positive anti HCV among the pregnant women who had a history of dental procedures ***(Murad et al. 2013)***.

Several potential risk factors for contracting HBsAg were evaluated including the history of surgical and dental procedures, cupping therapy and no significant association was observed between the history of surgical and dental procedures, cupping therapy, and HBsAg. This finding is similar to the results of Elsheikh in Sudan ***(Elsheikh et al. 2007),*** and it could be explained through the improvement in sterilization and hygienic practice.

The present study observed a higher statistically significant association between the overall prevalence of hepatitis viral B infection and the medical history to liver diseases or jaundice of pregnant women at level (P-value= 0.000) also with a history of blood transfusion at level (P-value= 0.04). This finding is similar to the finding reported in Sudan by Abuelgasim and Baraka. Abuelgasim and Baraka reported that the history

of jaundice is a risk factor for positive HBsAg. (41.7%) of the positive pregnant women have a history of jaundice (P=0.000), and there is a significant relationship identified between blood transfusion and risk of infection with HBV infection (P=0.044) ***(Abuelgasim & Baraka 2015).*** Oladeine, et.al, observed that the pregnant women with a history of blood transfusion had a higher prevalence of HBV although the difference was not statistically significant ***(Oladeine et al. 2013).***

An alternative study conducted by Amsalu et al. was in difference with the current study regarding the association between overall sero-prevalence of hepatitis B and C, and history of blood transfusion, and liver disease among pregnant women. Amsalu et. al, reported that a history of blood transfusion and history of liver disease was not found to be significantly associated with the positive sero-prevalence of hepatitis B and C infection ***(Amsalu et al. 2018)***. Additional observation reported by Anthony, et. al, found that the history of jaundice was not significantly associated with positive sero-prevalence of Hepatitis B and C infection among the pregnant women ***(Kirbak1 et al. 2017).***

CHAPTER SEVEN

CONCLUSION

AND

RECOMMENDATIONS

CHAPTER VII:

CONCLUSION AND RECOMMENDATIONS

7.1 Conclusion

This study aimed to determine the sero-prevalence of HBV and HCV infection and the associated risk factors among pregnant women attending the antenatal Clinic in the study area. A cross-sectional study on HBV and HCV infection among the target population was carried out during the study period March- June 2019.

In conclusion; this study revealed that:

1. The sero-prevalence of HBsAg was (3%) which moderate severity among the participating in pregnant women according to WHO.
2. The sero-prevalence of anti-HCV was found to be (0.7%) among the participating pregnant women.
3. There was no statistically significant association between the overall prevalence of hepatitis B virus and hepatitis C virus infection and the demographic characteristics of the pregnant women who participated in the study at (P-value >0.05).
4. There was a statistically significant association between the overall prevalence of hepatitis viral B infection and the history of liver diseases and the history of blood transfusion of pregnant women at level (P-value <0.05).

7.2 Recommendations

This research recommended that:

1. Introduce of routine screening for HBV and HCV for all pregnant women attending antenatal clinics in health care centers or hospitals during the antenatal period.
2. Using standard precaution and infection control measures to all risk factors such as blood transfusion, dental management, and who had an ear piercing that increases the prevalence of HBV and HCV infection.
3. Vaccination with HB Vaccine for newborn infants at birth for all newborns borne to of mothers found to be HBsAg positive to reduce and prevent the spread of HBV-infection.
4. Planning for conducting larger studies on the prevalence of HBV and HCV to support the findings so that ultimately this can be recommended as a policy.
5. Early case detection and proper treatment should be implemented, especially if the patient is a pregnant woman with jaundice.

7.3 Limitations of the Study

1. Research publications on prevalence of HBV and HCV infection among pregnant women in Yemen limited especially in Hadhramout Governorate.
2. There was a difficulty in creating a concrete relating study to the educational site due to war situation in the country, which made moving from the study site to the academic center limited.
3. This is a hospital-based study, and that pregnant women attending obstetrics and gynecology clinics for antenatal at this hospital level, are selected

populations of those likely to have obstetric complications. The exclusion of private patients could also affect the generalization of findings for this study.

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APPENDICES

APPENDIX (1)

استبانة حول
الانتشار المصلي والعوامل المرتبطة بعدوئ التهاب الكبد الفيروسي البائي والسيني بين النساء الحوامل في وادي العين، محافظه حضرموت- اليمن

رقم الاستبيان
الموافقة الرسمية

نحن نقوم حالياً بدراسة على الانتشار المصلي والعوامل المرتبطة بعدوئ التهاب الكبد الفيروسي البائي والسيني بين اليمن-النساء الحوامل في وادي العين، محافظه حضرموت
بمستشفى صالح بابكر الخيري وادي العين حضرموت.
وهذه الدر اسه تشرف عليها كلية العلوم الطبية بجامعة الرازي – صنعاء.
مشكلة صحية كبيرة في اليمن. ونحن نريد أن نعرف هل هذا المرض ينتشر بين C وB التهاب الكبد الفيروسي النساء الحوامل في منطقة وادي العين اليمنية. ونحن بطريقة المسح نختار المترددات من الحوامل على عيادة النساء والولادة بمستشفى صالح بابكر الخيري وادي العين حضرموت نشجعك على المشاركة لأن كلما شارك الناس أكثر في هذه الدراسة كلما أصبحت نتائج الدراسة مفيدة. من المتوقع أن تساعد نتائج هذه الدراسة وزارة الصحة لوضع خطط C و B للوقاية من الإصابة بالتهاب الكبد الفيروسي.
المعلومات التي سنأخذها منك ستحاط بالسرية التامة وفقا لأخلاقيات البحث العلمي، ولن تتأثر في مهنتك أو عملك بما سوف تدلي به من معلومات.
والآن، هل ترغبي بالاستفسار عن أي شيء في البحث؟
.نشكرك على الوقت الذي أمضيته في قراءة هذا النموذج ونحن مستعدون للإجابة على أي سؤال
إذا وافقت على المشاركة من فضلك وقعي أو أبصمي على الورقة في الأسفل.
مع الشكر،

الباحث: احمد عبد الله بن بركات
(777717395-714812780)

لقد قرأت (أو أحدهم قرأ لي) المعلومات عن هذه الدراسة وأفهم ما هو مطلوب مني لو شاركت في هذه الدراسة. جميع أسئلتي المتعلقة بهذه الدراسة تم الإجابة عليها.
أنا أوافق على المشاركة.

الرقم: - **اسم المقابل: -**
التاريخ: - **توقيع المقابل: -**

ضعي إشارة √على الإجابة المناسبة

الجزء الأول: البيانات الاجتماعية والديموغرافية:		
السؤال	الإجابة المتوقعة	الرمز
1. العمر	.....	
2. محل الإقامة	• حضر • شبة حضر	1 2
3. المستوى التعليمي	• امية • أساسي • ثانوي • جامعي	1 2 3 4
4. الوظيفة	• ربة بيت • عاملة	1 2
5. الحالة الاجتماعية	• متزوجة • منفصلة	1 2
6. نوع الحمل	• اولي • متعدد	1 2

الجزء الثاني: عوامل الاختطار والتاريخ المرضي:		
7. هل عملتي فحص لفيروسات الكبد البي والسي من قبل؟	• نعم • لا	1 2
8. هل نقلتي دم من قبل؟	• نعم • لا	1 2
9. إذا الإجابة نعم منذ متى تم نقل الدم؟	• أشهر • سنوات	1 2
10. هل عانيتي من اصفرار من قبل (مرض الصفار)؟	• نعم • لا	1 2
11. هل اجريتي عملية جراحية من قبل؟	• نعم • لا	1 2
12. إذا الإجابة نعم ما نوع العملية التي اجريتيها؟	• قيصرية • أخرى تذكر	1 2
13. هل خلعتي ضرس من قبل؟	• نعم • لا	1 2
14. إذا الإجابة نعم في أي مكان؟	• في عيادة الاسنان • خارج عيادة الاسنان	1 2
15. هل مارستي الحجامة من قبل؟	• نعم • لا	1 2
16. إذا الإجابة نعم كم مرة مارستي؟	• مرة واحدة • مرتين • ثلاث مرات	1 2 3
17. هل يوجد لديك وشم؟	• نعم • لا	1 2
18. إذا الإجابة نعم منذ متى اجري لك الوشم؟	.....	
19. هل يوجد لديك خشف في اذنك؟	• نعم • لا	1 2
20. إذا الإجابة نعم متى اجري لك؟	.....	

Questionnaire about

Seroprevalance and associated factors of viral hepatitis B and C infection among pregnant women in Alaeen Valley, Hadhramout Governorate, Yemen

No. of Questionnaire

informed consent

We are currently carrying out a study on Seroprevalance and associated factors of viral hepatitis B and C infection among pregnant women attending the obstetrics and Gynecology clinic at Saleh Babker welfare hospital Alaeen Valley, Hadhramout Governorate.

This department is supervised by the Faculty of Medical sciences at al-Razi University-Sana'a.

Viral hepatitis B and C are a major health problem in Yemen. We want to know if this disease is among pregnant women in the Yemeni valley of the eye. We are scanning method we choose from pregnant women on the clinic... Women and childbirth at Saleh Babker Hospital, Alaeen Valley, Hadhramout Governorate.

We encourage you to participate because the more people participate in this study the more the results of the study become useful. The results of this study are expected to help the Ministry of Health to develop plans to prevent hepatitis B and C infection.

The information we will take from you will be strictly confidential according to the Ethics of scientific research, and will not be affected in your profession or work by the information you will provide.

Now, would you like to inquire about anything in the search?

Thank you for the time spent reading this form and we are ready to answer any question.

If you agree to participate, please sign or shut down the paper below.

Thanks,

Researcher

Ahmed Abdullah Bin Barakat

(777717395-714812780

I have read (or someone who read Me) information about this study and I understand what is required from me if I participate in this study. All my questions related to this study have been answered.

I agree to participate.

Number: - Corresponding name: -

Date: - Corresponding signature: -

Signature or imprint of the participant.

Please provide a copy of this form for participation

Signature of the opposite: -signature or fingerprint participation.

Mark the (√) on appropriate answer

Part I: Sociodemographic data:		
Question	**Expected answer**	**Code**
1. Age	**.....**	
2. Residence	Urban Semi Urban	1 2
3. Education level	Illiterate Basic Secondary Undergraduate	1 2 3 4
4. Occupation	Housewife Worker	1 2
5. Marital status	Married Separate	1 2
6. Parity	Prmigravide Multigravida	1 2

Part II: Risk factors and Medical History:		
7. Have you ever had Hepatitis B and C test before?	• Yes • No	1 2
8. Have you ever transfused blood before?	• Yes • No	1 2
9. If yes, since when has the blood been transferred to you?	• Months • Years	1 2
10. Have suffered of yellowing by the Jaundices disease before?	• Yes • No	1 2
11. Have you ever had an operation before?	• Yes • No	1 2
12. If yes, what kind of surgery?	• Cesarean • another operation	1 2
13. Have you ever had a tooth before?	• Yes • No	1 2
14. If yes, is it in the?	• Dental Clinic • Out Side Clinic	1 2
15. Have you ever cupping before?	• Yes • No	1 2
16. If yes, how many times have you been cupping?	• Once • Twice • Three Times	1 2 3
17. Do you have a tattoo?	• Yes • No	1 2
18. Do you have a tattoo?	**.....**	
19. Are you in your ear piercing?	• Yes • No	1 2
20. If yes, when did you run?	……	

APPENDIX (2)

Ethical Approval

Republic of Yemen
Ministry of Higher Education and Scientific Research
Al-Razi University

الجمهورية اليمنية
وزارة التعليم العالي والبحث العلمي
جامعة الرازي

الأخ / مدير مستشفى صالح بابكر الخيري المحترم

بعد التحية ،،،

الموضوع / السماح للباحث بعمل استبيان لإنجاز رسالة الماجستير

تهديكم جامعة الرازي أطيب التحايا، متمنين لكم دوام التوفيق في جميع اعمالكم

بالإشارة إلى الموضوع أعلاه وفي إطار التعاون والتبادل العلمي وبناءً على المساهمة في خدمة المجتمع نرسل إليكم **الباحث/ احمد عبدالله بن بركات** من الطلاب الدارسين في الجامعة (ماجستير وبائيات) للعام الجامعي٢٠١٨-٢٠١٩م وذلك بهدف عمل استبيان لإنجاز رسالة الماجستير بعنوان:

Seroprevalence and Associated Risk Factors of Viral Hepatitis B And C Infection among Pregnant Women in Aleen Valley Hadhramout Governorate, Yemen

وعليـــــــــــــــــــه/

نأمل أن تتكرموا مشكورين بالتوجيه لمن يلزم بتسهيل مهام الباحث.

وتقبلوا خالص التحية والتقدير،،

عميد كلية العلوم الطبية
أ.د/ نبيل الربيعي

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