**Original Research Article**

**Seroepidemiology and risk factors of Hepatitis B Virus**

**in Jiblah Town, Yemen.**

**Abstract:**

Viral Hepatitis is a major global health problem affecting millions of people worldwide. Chronic Hepatitis B is among the preventable leading causes of death worldwide. The endemicity of hepatitis B virus infection used to be believed high in Yemen. Data for prevalence of hepatitis B virus in Jiblah Town in Yemen is rare and inadequate. Therefore, this study aimed to assess the seroprevalence of Hepatitis B virus and associated risk factors in the general population of Jiblah Town, Yemen. A total of 100 participated included in this study. Serum samples were collected and assayed for HBsAg using the ELISA quantitative technique. A structured questionnaire was used to collect behavioral and sociodemographic data.The results revealed that***,*** the seroprevalence of hepatitis B virus was 3.33%. There was statistically significant differences between hepatitis B virus infection and monthly income.The finding of this study indicated that the magnitude of hepatitis B virus infection among the general population was intermediate level. Modifiable risk factor, monthly income was identified.

**Keywords:** Seroepidemiology, Hepatitis B virus,, epidemiology, Jiblah, Yemen.

**INTRODUCTION**

Hepatitis is an inflammation of the liver that is caused by a variety of infectious viruses and non-infectious agents leading to a range of health problems and burden for the healthcare system, some of which can be fatal. Hepatitis (all types) represents the seventh leading cause of worldwide mortality (16). All such infections are caused by five viruses, namely Hepatitis A virus (HAV), Hepatitis B virus (HBV), Hepatitis C virus (HCV), Hepatitis D virus (HDV), and Hepatitis E virus (HEV) (18). During 2019, the World Health Organization (WHO) estimates that 296 million people worldwide are living with HBV and 1.5 million people were newly infected with HBV (31).

Hepatitis B can lead to lifelong infection. WHO estimates that 1.1 million deaths occurred in 2019 due to this infection and its effects including; liver cancer, cirrhosis, and other conditions caused by chronic viral Hepatitis(31).In 2016, the WHO Global Health Sector Strategy called for Hepatitis elimination by 2030 through scaled-up prevention, testing, and treatment. Elimination of Hepatitis as a public health threat was defined as a 90% reduction in incidence and a 65% reduction in mortality, compared with the 2015 baseline (33). The status of HBV infection varies significantly from one part of the world to another and changes over time (8). The WHO estimates that 3.3% of the general population living in the Eastern Mediterranean region (EMR) are infected with HBV (2).The rate of HBV infection varies from high- (>8% infection rate) to intermediate- (2%–8%) and low-endemicity (<2%) areas(8). Iran, Bahrain and Kuwait are areas of low endemicity, Iraq, Cyprus and the United Arab Emirates have intermediate endemicity, and Palestine, Yemen, Egypt, Oman, Jordan, and Saudi Arabia have high endemicity (12).Previous data showed that HBV is hyper endemic in Yemen, and infection with HBV is an important cause of chronic liver (7). The prevalence of HBV infection among blood donors ranges from 2% to 18%, as documented by many studies, where Yemen consequently falls into the intermediate to high endemicity category (27).Most previous epidemiologicalstudies were done in different cities in Republic ofYemen, showed that the prevalence rates of HBsAg are (10.5%) in Sana’a,(4.75%) in Aden, (5.6%) and inHajah, (26.3%) in Socotra,respectively (26) and (1.81%) in Ibb City (24).

Jiblah is a town in south-western [Yemen](https://en.wikipedia.org/wiki/Yemen), eight kilometers south, south-west of [Ibb](https://en.wikipedia.org/wiki/Ibb), in the [governorate of the same name](https://en.wikipedia.org/wiki/Ibb_Governorate). The town and its surroundings were added to the [UNESCO](https://en.wikipedia.org/wiki/UNESCO) [World Heritage](https://en.wikipedia.org/wiki/World_Heritage) Tentative List due to its purported universal cultural value (15). There have been no previous studies to describe risk factors for HBV and HCV in Jiblah. Therefore, the aim of the present study is to determine the current seroprevalence of HBV, as well as the epidemiological factors involved in the presence of the infection in the general population of Jiblah Town in Yemen.

**MATERIALS AND METHODS**

This study was a community-based cross–sectional study conducted in Jibla Town, Yemen in March 2023. A total of 120 subjects were randomly selected by random sampling of with a 100% response rate. Five ml of venous blood was drawn under aseptic conditions, then sera were screened for Hepatitis B surface antigen (HBsAg) using commercial kits (One step HBsAg Test, Intec, China). Positive samples were confirmed by enzyme immunoassay (EIA) for Hepatitis B surface antigen with commercially kits (Fortress Diagnostic Ltd. UK). Participants’ Socio- demographic variables, HBV vaccination status, knowledge of infectious agents and risk factors of HBV were carefully collected using pre-tested standard questionnaire to obtain relevant information. Collected data were encrypted and entered into SPSS Version 20 . The percentage of variables for each category provided was quantified. Statistical comparison between categorical variables was performed using Chi-squared pair test, and *P* < 0.05 was considered to indicate significance.

**RESULTS**

In this study, overall seroprevalence of HBV infection among study population was 3.33%.as shown in fig. 1. Table (1) outlines, the age of the participants ranged from 6 to 70 years with a mean of 39.1 years. HBV prevalence was higher with older age groups, but this was statistically insignificant (*P* value0.999). Of the total, 87 (72.5%) were males and 33 (27.5%) females. Although there was no association between HBV infection and gender, the percentage of HBV infection among males were 4 (4.6%) which is higher than in females. Married participants were 92 (76.67%), while unmarried were 28 (23.33%) and HBV infection was higher in married people 4 (4.35%), but this was statistically insignificant (*P* value0.999). Regarding the educational status of the respondents, about 94 (78.33%) were educated and the rest 26 (21.67%) of them had no education. The present study showed highest seroprevalence of HBV infection among non-educated subjects 2 (7.69%) and lowest educated subjects 2 (2.3%). The difference found wass tatistically insignificant (*P* value0*.*634). Most participants 55 (45.83%) had monthly income less than YR 30,000 (approximately US$ 54.5) and only 4 (3.33%) of participants had more than YR 80,000 (approximately US$ 145.5). The difference found was statistically insignificant (*P* value 0*.*000).

**DISCUSSION**

According to the Yemeni National Infectious Viral Hepatitis Control Program, Yemen was recognized as HBV-endemic area. In 1998, the World Health Organization (WHO) recommended the inclusion of HB vaccine in the National Immunization Program of Yemen. Yemen introduced a universal immunization program against HBV for infants and high risk groups in early 2000 (14). The incidence of acute HBV has declined dramatically in the past decade since the start of the vaccination Program, especially among young people, although it may still take several decades until the effect of vaccination is translated into reduced transmission and morbidity (14).Yemen consequently falls into the intermediate to high endemicity category(27,8).WHO found that the rates of HBV infection in the general population globally and in the Eastern Mediterranean Region were 3.5% and 3.3%, respectively. Most Middle Eastern countries are developing nations with sub-optimal health care infrastructures and Yemen is one of the least developed; it has very limited resources (22). More recent studies within the region indicated that the seroprevalence was lowest in Saudi Arabia (0.28%) and highest in Jordan and Iraq (0.52% and 2.30%, respectively) (22). However, in Yemen, recent studies reported a lower rate of HBsAg in which it ranges from 0.7-2% among general population (3). This study presented that, the prevalence rate of HBsAg was 3.33%. Yemen has been the site of political conflict since 2014; the violence has steadily escalated since, leading to one of the worst humanitarian crises today. The country’s instability has made obtaining the most reliable epidemiological data on HBV infection among the general population in Yemen very challenging.HBV seroprevalence is variable between different geographical regions in Yemen. The prevalence of HBsAg in this study was higher than that study carried out in Ibb 1.81% (24) and lower in that studies in Sana'a 4% (21), Aden 4.75%, Hajah 5.6% and in Socotra 26.3% (27).The varied differences between this study and other studies might be due to the differences in the geographical distribution of the infection in the society, population differences regarding social behavior, lifestyle, socioeconomic status, and level of awareness in different regions of the country. Moreover, study duration, study settings and differences in specificity and sensitivity of screening tests used at different sites during the time of screening, might be the causes of variations. In addition, individuals in more advanced nations get proper vaccines. The present results indicate that, there is no significance between HBV infection and the age of subjects (*P* value0.999). This is in line with a previous studies in Yemen and Iran (12,22, 25, 28). Similar studies in Yemen and other countries have shown that, the seropositivity of HBsAg rises as age increases, and that the age is one of the independent predictors of acquiring HBV infection (9,23,24, 27).This would probably be the birth cohort effect and presumptively due to a lack of immunization against HBV in their times. The prevalence of HBV in both genders is controversial. While some studies showed that males revealed a significant higher level of HBV than female (29, 31, 33,34, 10).However other population based surveys showed there is no significant relationship between HBV infection and gender(23, 13, 29, 9). In this study, seroprevalence was higher in males 4 (4.6%), but there is no significant difference (*P* value 0.666).In this study, it was found that marital status was insignificantly associated with HBV infection (*P* value0.999) which is similar to studies conducted in Sana'a City (33, 25), and Aden City (1) and some studies conducted in Ethiopia(6,13).Other studies show that marital status was significant predictor for HBV infection. married participants compared to participants who non-married were more likely to have HBV infection (10). However, some studies showed that unmarried donors were more likely to be infected with HBV. Similar findings have been reported from a study conducted in the different study areas(23, 31, 24).The varied differences between this study and the others might be due to differences in study duration and study settings that could affect social behavior, lifestyle, and socioeconomic status that predispose to HBV infection. The present study also showed insignificant association between educational level and HBsAg seroprevalence (*P* value 0.624) despite the reports that associate higher education levels and good health. The result of this study is similar to studies conducted in Aden city (1, 4) and study carried out in Sana'a city among blood donors (22),in addition to the recent study that conducted in 2022, among general population in Egypt (10)and studies carried out among blood donors in Ethiopia (6, 17). Others studies revealed high prevalence of HBV infection in less educated individuals such as study conducted in Sana’a City, Yemen, among pregnant women (11) and study carried out in Ethiopia among general population (13). This study likewise revealed high prevalence of HBV infection among people who had monthly income (*P* value 0.000). Most Middle Eastern countries are developing nations with sub-optimal health care infrastructures and Yemen is one of the least developed; it has very limited resources (30). 27% of people live under the food poverty line, and 42% are under the national income poverty line. In Yemen, poverty is more of a rural than urban phenomena (32). Monthly income of the individual plays an important role in determining the level of health status. As is well known, poverty is a key factor in the spread of common diseases.

**CONCLUSION**

The findings of this study indicated that the magnitude of HBV infection among the general population was intermediate level. The prevalence of hepatitis B in Yemen is still high compared to many other countries. There are some geographic areas in the country that may be at high risk. Control strategies should take these differences into account. Modifiable risk factor, monthly income was identified. Yemen has been the site of political conflict since 2014; the violence has steadily escalated since, leading to one of the worst humanitarian crises today. The country’s instability has made obtaining the most reliable epidemiological data on HBV infection among the general population in Yemen very challenging.

**ACKNOWLEDGEMENTS**

We thank Dr. Abdullah Almatari, the President of Jiblah University of Medical and Health Sciences, for cooperation in this study. Our thanks to Mr Nabeel M. Al-Qassem for his cooperation in this study. Also we thank Ahlam Alsaber for helping in laboratory field work in Jiblah university hospital.

**FUNDING**: None

**CONFLICT OF INTEREST**

The authors declare that they have no conflict of interest.

**REFERENCES**

1. A.A. Al-Waleedi and Y.S. Khader. Prevalence of hepatitis B and C infections and associated factors among blood donors in Aden city, Yemen. EMHJ Vol. 18 No. 6, 2012.
2. Ali A. Alali and Mahmoud N. Abo‑Shehada. Prevalence of Hepatitis B Virus infection in the Gulf Cooperation Council: a systematic review and meta‑analysis. BMC Infectious Diseases (2022) 22:819.
3. Ahmed Mohsen Al-kadassy, Hassan A. Al-Shamahy, et al. Prevalence and Potential Risk Factors of Hepatitis B Virus in a Sample of Children in Two Selected Areas in Yemen. Global Journal of Medical Research: C Microbiology and Pathology Volume 19 Issue 1 Version 1.0 Year 2019.
4. Amen Ahmed Bawazir, Christopher M. Parry, C., e t al. Seroepidemiology and risk factors of hepatitis B virus in Aden, Yemen. Journal of Infection and Public Health (2011) 4, 48—54
5. Almagul Jumabayeva, Alexander Nersesov, et al. Prevalence of Viral Hepatitis B, C, and D in Kazakhstan. The Scientific World Journal Volume 2022, Article ID 9102565, 8 pages.
6. Ayenew Assefa, Dibekulu Shiferaw, et al. Seroprevalence of Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) among Blood Donors from Bahir Dar, Ethiopia. Advances in Public Health Volume 2022, Article ID 5073171, 9 pages.
7. B.A.H. Al-Masoodi, A. Reem, S.S. Bahaj, et al. Prevalence of occult hepatitis B virus infection among patients receiving haemodialysis in Sana’a city. IJID Regions 5 (2022) 141–145.
8. Beykaso, et al. Burden and Transmission Risks of Viral Hepatitis in Southern Ethiopia: Evidence Needed for Prevention and Control Measures. Risk Management and Healthcare Policy 2021:14.
9. Davaalkham Dambadarjaa, et al. Hepatitis B, C, and D Virus Infection among Population Aged 10–64 Years in Mongolia: Baseline Survey Data of a Nationwide Cancer Cohort Study. Vaccines 2022, 10, 1928. <https://doi.org/10.3390/vaccines10111928>.
10. Eman Raslan1 , Mohamed AbdAllah2 and Saeed Soliman. The prevalence and determinants of hepatitis B among Egyptian adults: a further analysis of a country‑representative survey.Egyptian Liver Journal (2022) 12:46.
11. Entisar A Murad, Suad M Babiker, et al. Epidemiology of hepatitis B and hepatitis C virus infections in pregnant women in Sana’a, Yemen. BMC Pregnancy and Childbirth 2013, 13:127.
12. Farshad Nojoomi, et al. High prevalence and risk factors of hepatitis B, C and E infections among Middle Eastern countries. Immunopathol Persa. 2018;4(2):e1.
13. Gizachew Beykaso, Andargachew Mulu, et al. Burden and Transmission Risks of Viral Hepatitis in Southern Ethiopia: Evidence Needed for Prevention and Control Measures. Risk Management and Healthcare Policy 2021:14 4843–4852.
14. Hassan A Al-Shamahy, Samira H Hanash,et al. Hepatitis B Vaccine Coverage and the Immune Response in Children under ten years old in Sana’a, Yemen. SQU Med J, February 2011, Vol. 11, Iss. 1, pp. 77-82, Epub. 12th Feb 11.
15. [Jibla and its surroundings](https://whc.unesco.org/en/tentativelists/1721/), [UNESCO](https://en.wikipedia.org/wiki/UNESCO) World Heritage Centre*,* retrieved 2009-04-20.
16. Joseph K. Lim, Mindie H. Nguyen, et al. Prevalence of Chronic Hepatitis B Virus Infection in the United States. Am J Gastroenterol 2020;115:1429–1438.
17. Khaled Al Nassiri, Yahia Raja'a. Hepatitis B infection in Yemenis in Sana'a: Pattern and risk factors. Eastern Mediterranean health journal. Vol. 7. Nos 1/2, 2001.
18. [Meryem Jefferies](https://pubmed.ncbi.nlm.nih.gov/?term=Jefferies%20M%5BAuthor%5D), et al. Update on global epidemiology of viral hepatitis and preventive strategies. [World J Clin Cases.](https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6232563/) 2018 Nov 6; 6(13): 589–599.
19. Milkias Abebe, Birhan Alemnew , Sirak Biset . Prevalence of Hepatitis B Virus and Hepatitis C Virus Among Blood Donors in Nekemte Blood Bank, Western Oromia, Ethiopia: Retrospective 5 Years Study. Journal of Blood Medicine 2020:11 543–550.
20. Mohammad Amin Behzadi, Victor Hugo Leyva-Grado1, et al. Seroprevalence of viral hepatitis A, B, C, D and E viruses in the Hormozgan province southern Iran. BMC Infectious Diseases (2019) 19:1027 <https://doi.org/10.1186/s12879-019-4661-4>.
21. Nabehi BAH, Al- Shamahy H, et al. Sero-molecular epidemiology and risk factors of viral hepatitis in urban Yemen. Int J Virol 2015; 11: 133-138.
22. Naif Tawfeq, Norfazilah Ahmad, et al. Seroprevalence of Hepatitis B Virus Infection and It's Associated Factors Among Blood Donors in Yemen.Malays J Med Sci. 2021;28 (5):54–63.
23. Negash M, Ayalew M, Geremew D, Workineh M. Seroprevalence and associated risk factors for HIV, Hepatitis B and C among blood Donors in South Gondar District blood Bank, Northwest Ethiopia. BMC Infect Dis. 2019;19:430. doi:10.1186/s12879-019-4051-y.
24. Rajesh Nivarti Gacche, Al Mohani Sadiq Kaid. Epidemiology of Viral Hepatitis B and C Infections in Ibb City, Yemen. *Hepat Mon*. 2012;**12** (7): 460-2. DOI: 10.5812/ hepatmon.6140.
25. Shabir Ahmad Mir, Bader Alshehri. Seroprevalence of hepatitis B and C viral infections in the premarital adult population of Al Majmaah, Saudi Arabia. Malawi Medical Journal 33 (3); 221-225 September 2021.
26. Tawfique Al-Zubiery, et al. Sero-Prevalence of HBs Ag, HCV and HIV among Blood Donors in Three Blood Bank Centers in Sana'a city: Yemen. Journal of Biotechnology and Biomedical Science. Dec 1, 2017. Vol-1 Issue 1 Pg. no.– 46.
27. Tawfique KA Alzubiery, Talal Alhazari, et al. Updated Seroprevalence of Hepatitis B Surface Antigen and Anti-Hepatitis Core Antibody Among Blood Donors in Yemen. Infection and Drug Resistance 2022:15.
28. The EASL International Liver Foundation. Micro-elimination of Hepatitis C, Virus in the Middle East. *Report of an expert workshop* in Dubai on 28th September 2019.
29. Waleed Hasan Mohammed Al-Marrani, Hassan A. Al-Shamahy. Prevalence Of HBV And HCV; and Their Associated Risk Factors Among Public Health Center Cleaners At Selected Public Health Centers In Sana'a City-Yemen. Universal Journal of Pharmaceutical Research 2018; 3(5):58-6238).
30. World Bank. The story: race against time to deliver services and support to Yemenis. World Bank; 2020 [Retrieved 2020 June 18]. Available at: <https://www.worldbank.org/en/> news/feature/2020/06/03/race-against-time-to -deliver-services-and-support-to-yemenis.
31. World Health Organization. Global progress report on HIV, viral hepatitis and sexually transmitted infections, 2021. Available at: <https://www.who.int/publications/i/item/9789240027077>.
32. WHO, Country Cooperation Strategy for WHO and the Republic of Yemen 2008–2013 Republic of Yemen, 2009.
33. WHO. Global health sector strategy on viral hepatitis 2016–2021. Towards ending viral hepatitis. Geneva, Switzerland: World Health Organization, 2016.
34. Y.A. Mohamoud, et al. International Journal of Infectious Diseases 46 (2016) 116–125118.

Figure 1. Shows Percentage of HBV Infection in Jiblah town

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Table 1: Sociodemographic characteristics of studied population (n = 120).** | | | | | |
|  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |
|  | *P* value | HBsAg (%.) | HBsAg (NO.) | % | No. | Variable |
|  |
|  | 0.999 |  |  |  |  | Age (years) |
|  |  | 0 | 0 | 2.5 | 3 | ≤ 15 |
|  |  | 0 | 0 | 15.83 | 19 | 16-25 |
|  |  | 2.86 | 1 | 29.17 | 35 | 26-35 |
|  |  | 2.86 | 1 | 19.17 | 23 | 36-45 |
|  |  | 2.86 | 1 | 18.33 | 22 | 46-55 |
|  |  | 2.86 | 1 | 9.17 | 11 | 56-65 |
|  |  | 0 | 0 | 5.83 | 7 | ≥75 |
|  | 0.666 |  |  |  |  | Gender |
|  |  | 4.6 | 4 | 72.5 | 87 | Male |
|  |  | 0 | 0 | 27.5 | 33 | Female |
|  | 0.999 |  |  |  |  | Marital status |
|  |  | 4.35 | 4 | 76.67 | 92 | Married |
|  |  | 0 | 0 | 23.33 | 28 | Non-married |
|  | 0.624 |  |  |  |  | Education status |
|  |  | 7.69 | 2 | 21.67 | 26 | Unable to read and write |
|  |  | 0 | 0 | 22.5 | 27 | Primary education |
|  |  | 4.55 | 2 | 36.67 | 44 | Secondary education |
|  |  | 0 | 0 | 19.17 | 23 | Graduate education |
|  | 0.000 |  |  |  |  | Monthly income |
|  |  | 3.64 | 2 | 45.83 | 55 | Less than RY. 30000 |
|  |  | 2 | 1 | 41.67 | 50 | RY. 30000-50000 |
|  |  | 9.1 | 1 | 9.17 | 11 | More than 50000-80000 |
|  |  | 0 | 0 | 3.33 | 4 | More than RY. 80000 |