Review on Determinants of Hepatitis B Viral Antigens and Antibodies among HBV Positive Patients in Sub-Saharan Africa

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ABSTRACT

Hepatitis B is a viral infection which can be deadly if not treated, supervised and managed properly. It accounts for the majority of death cases in Sub-Saharan Africa. Policy makers and Governmental institutions need to be informed in order to help in the management of the disease which will thereby decrease death toll. This review was undertaken to identify the determinants of Hepatitis b viral antigens and antibodies among Hepatitis B positive patients in Sub-Saharan Africa. Google Scholar database site was searched from February 3rd to February 7th 2023 for peer-reviewed papers on causes of Hepatitis B viral load in Sub-Saharan Africa. A total of 17 articles were retrieved from the web database which included 12 countries which reported outcomes of 9,682 patients mostly 50.93% (4,931) females and 49.07% (4,751) males. More than half of the participants were co-infected with HIV and mostly were pregnant or had Chronic Hepatitis b. Males were mostly seen to have elevated levels of Hepatitis B viral load than Females. Attitudes such as poor adherence and alcohol consumption were seen to be contributing determinant of hepatitis b viral load. Hepatitis B Genotype E was found to have high viral loads than other genotypes. It is important to do routine screening of hepatitis B genotype and viral load test which can help in management and reduce risk of having chronic liver damage and cancer. Governmental institutions and policy makers should provide programs that will guide patients in adhering to anti-viral drugs intake and having a good lifestyle.

Keywords: Hepatitis B, Viral load, Hepatitis B antigens, Chronic diseases, Viral diseases.

1 Introduction

Hepatitis B virus belongs to the hepadna-virus family, which also includes duck hepatitis virus, wood chuck virus, and ground squirrel hepatitis virus. The virion particle is 42nm in diameter and is a partially double-stranded DNA virus. An envelope made up of virally encoded proteins and lipids derived from the host. The nucleocapsid protein, viral genomes, and the polymerase protein form the core particle. The Hepatitis B Virus is a virus that spreads through the blood and infects the liver. (Rani et al, 2009). A person can contract the hepatitis B virus (HBV), by coming into contact with an infected person's blood, saliva, sweat, urine, or feces (Sondlane et al., 2016). Viral hepatitis B (VHB) is a liver inflammatory disease caused by the hepatitis B virus (HBV). It is a major public health problem in terms of its severity and progression toward chronicity, as well as the number of affected subjects and the variety of clinical forms. (Somé et al, 2021).

In the acute state, the infection occurs quickly and is possibly cleared by the immune system. However, the virus can survive for a longer period of time and cause chronic infection (Robotin et al, 2014). In the chronic state, most serious complications of chronic hepatitis B are Cirrhosis and Hepatocellular Carcinoma. These complications affect between 20% and 30% of those who become chronically infected, and an estimated 650, 000 people die each year as a result of it (WHO, 2015).

Despite the availability of effective vaccines and treatments for hepatitis B virus (HBV), it continues to be a major public health problem in sub-Saharan Africa. Routine screening for Hepatitis B virus and intake of anti-viral medicines are widely recommended, but there is lack of management for Hepatitis B positive patients in sub-Saharan Africa. This increases their viral load and makes them susceptible to liver diseases and even death. Therefore, this review aimed to assess the determinants of Hepatitis B viral antigens and antibodies load in Hepatitis B positive patients in Africa which will aid at informing policy decision on Hepatitis management.
2 Methodology
The review was carried out in accordance with the guidelines for preferred reporting items for systematic reviews and meta-analyses (PRISMA). Google Scholar was used to search for literature. The search began on 3rd February, 2023. The terms “Hepatitis B”, “Causes of hepatitis b viral load”, “Hepatitis b in Africa” were used in the search. The search results were then filtered to remove duplicates and non-English results. Any studies classified as 'non-human' in the databases were also removed. Those publications that were left were evaluated for their relevance to the inclusion criteria by screening their titles and abstracts first, and then the full-texts.

Inclusion criteria: Studies were included if they presented original data excluding review papers, were published in English and as a peer-reviewed paper and involved participants from Africa. Data extraction: Details about the author with year of publication, sample size, type of study, Age range or mean, sex, study population, determinants and study country were tabulated for each included paper. Other details thought to be important in understanding the study were also recorded.

Data were inspected visually. Data such as Age were calculated as means if they were presented in groups (for example group A=20, group B=30, group C =25 mean age=20+30+25/3) and those that were presented as age range were left as it was. Data that were not present due to restricted access to full article were presented as NA.

3 Results Of Literature Search
Table 1 shows a summary of the retrieved papers according to the number of countries, number of females, males and mean age. A high proportion of females took part in the studies and the mean age for all participants was 37.98.

Table 2 displays the search results on descriptive characteristics of the population studied in each paper. The descriptive characteristic consists of the Author, year publication, country, sample size, type of study, Age, Sex and the type of study population. As this review paper is purely qualitative, points of interest for each study were identified and compiled for comparison analyses which can be seen in Table 3. It was found that a comparable of studies identified hepatitis b genotype, age, sex, cost and accessibility of antiviral drugs, HIV co-infection, poor adherence, type of antigens and underlying diseases as determinants or predictors of Hepatitis B viral load.

Table 1: A table describing the total number of countries studied, total number of females and males and mean age.

<table>
<thead>
<tr>
<th>NO. of countries studied</th>
<th>No of Females</th>
<th>No. of Males</th>
<th>Mean Age (Excluding mean range values)</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>4931 (50.93%)</td>
<td>4751 (49.07%)</td>
<td>37.98</td>
</tr>
</tbody>
</table>

Table 2: Descriptive characteristics of the population studied in each paper. This includes the sample size, type of study, Age in median range or mean, sex and type of study population.

<table>
<thead>
<tr>
<th>Author, Year, Country</th>
<th>Sample size</th>
<th>Type of study</th>
<th>Age range/mean</th>
<th>Sex</th>
<th>Study population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Akande &amp; Akere, 2019, Nigeria</td>
<td>121</td>
<td>Cross-sectional study</td>
<td>18-68</td>
<td>46</td>
<td>75</td>
</tr>
<tr>
<td>Archampong et al, 2015, Ghana</td>
<td>235</td>
<td>Cross-sectional design</td>
<td>41</td>
<td>139</td>
<td>96</td>
</tr>
<tr>
<td>Bell et al, 2012, South Africa</td>
<td>298</td>
<td>Rural cohort</td>
<td>34</td>
<td>184</td>
<td>114</td>
</tr>
<tr>
<td>Desalegn et al, 2018, Ethiopia</td>
<td>328</td>
<td>Treatment based pilot study</td>
<td>35</td>
<td>131</td>
<td>197</td>
</tr>
</tbody>
</table>
Duah and Nartey, 2023. Ghana

Prospective hospital-based study 38.67 172 162 Newly diagnosed chronic hepatitis B patients

Mahgoub et al, 2011. Sudan

laboratory based 18-50 1 403 Blood donors

Maina et al, 2017. Kenya

laboratory based 36.7 150 40 HIV-1-infected patients

Mena et al, 2022. Senegal

Cross-sectional study 38.5 273 308 Hepatitis B viral patients

Mendy et al 2008. Gambia

Cross-sectional survey 1 to 4 22 46 HBsAg chronic carriers

Mendy et al, 2010. Gambia

Case control study 40.67 44 198 HBsAg-positive persons

Okwuraiwe et al, 2011. Nigeria

laboratory based 36.8 153 441 HBsAg positive patients

Selabe et al, 2007. South Africa

Exploratory study NA NA NA HBV infected patients with or without HIV co-infection

Somé et al, 2021. Burkina Faso

Cross-sectional descriptive study 38.7 130 195 Chronic HBsAg-negative hepatitis B

Thompson et al, 2021. Congo

Feasibility study 25-34 90 0 Pregnant women

Wandeler et al, 2016, Mozambique and Zambia

Laboratory based 32.5 1186 643 HIV/HBV Co-infected patients


laboratory based 37.5 2188 1756 Chronic hepatitis B HBsAg+

Yousif et al, 2013. Sudan

Cross-sectional, laboratory based 45.7 22 77 Patients with liver diseases

Table 3: Determinants of hepatitis B viral load in some identified papers with the author, year of publication and country.

Author, Year, Country | Determinant/Predictors
--- | ---
Akande & Akere 2019, Nigeria | Younger people had higher HBsAg. Chronic hepatitis B infection and e negative antigenemia have low viremia and high qHBsAg quantification.
Archampong et al, 2015, Ghana | Sex:Males had higher HBV than females, high serum alanine Aminotransferase in blood = high HBV load
Bell et al, 2012, South Africa | Age: Increase in age in females a significant predictor of HBV DNA positivity. Older men had lower CD4 cell counts.
Desalegn et al, 2018, Ethiopia | Patients with cirrhosis had a high viral load after treatment with anti-viral drugs
Duah and Nartey, 2023, Ghana | Inaccessibility and high cost of hepatitis B viral load test, High cost of anti-viral drugs
Mahgoub et al, 2011, Sudan
Genotype E had higher viral loads than genotype D

Maina et al, 2017, Kenya
Co-infection with HIV increases viral load

Mena et al, 2022, Senegal
Male sex and elevated serum alanine Aminotransferase, alcohol consumption, above 40 years, HIV positive, use of traditional medicines, BMI greater than 25.

Mendy et al, 2008, Gambia
Early contraction: Viral load decreases significantly with time

Mendy et al, 2010, Gambia
Cirrhosis and hepatocellular carcinoma had higher viral load than asymptomatic HBV patients

Okwuraiwe et al, 2011, Nigeria
HBsAg positive had high viral load and at risk of liver cancer

Selabe et al, 2007, South Africa
Drug resistance: Hepatitis B viral lamivudine resistant strains were found majorly in HBV-HIV co-infected patients

Somé et al, 2021, Burkina Faso
High viral load in anti-HBeAb and alcohol consumption

Thompson et al, 2021, Congo
Poor adherence to intake of tenofovir diphosphate caused high viral load

Wandeler et al, 2016, Mozambique and Zambia
1. HBeAg-positive patients had a high DNA levels, whereas the majority of HBeAg-negative individuals had a low DNA levels

Wongjarupong et al, 2020, Burkina Faso
Genotype E had lower viral load than Genotype C/E or C

Yousif et al, 2013, Sudan
Genotype E had higher HBeAg-positivity and viral loads than genotype D

4 Discussion
A high number of females were involved in the retrieved articles. This could imply that women are mostly affected by Hepatitis B. The attitudes that influence the transmission of Hepatitis B include piercing, sharing of combs, liposuction, needle use et cetera are mostly expressed in females than males and hence could be one of the reasons for this outcome.

This review found that a majority of the population that was of interest to the authors were HIV patients. This could mean that HIV patients are of importance in Hepatitis B management. A reason could be their immune system being suppressed and hence have an increase in viral load. In terms of sex, males had higher viral load than females. This could mean that females have something that prevents viral reactivation and increase than men. In studies done by Nussinovitch and Shoenfeld (2012), a larger proportion of female HBV patients than male HBV patients experienced immunological clearance of serum HBeAg and HBsAg. Additionally, female participants were shown to have the seroconversion from HBeAg to anti-HBe and from HBsAg to anti-HBs more frequently than males. According to Wang et al (2015), this could be as a result of active androgen pathway certified to be associated with an increased risk of HCC development, indicated by both higher serum androgen levels and more activated AR gene alleles.

A number of studies identified Hepatitis B genotype E as a determinant of increase in viral load among hepatitis B patients. One study had a contradictive result among Burkina Faso participants. Burkina Faso and Sudan are geologically situated differently in Africa. This could explain the discrepancies in the result.

The presence of hepatitis B surface antigens was also one determinant of viral loads in patients which can be observed from the studies of Yousif et al, 2013, Okwuraiwe et al, 2011 and others. This shows that Hepatitis B patients should have routine screening specifically on their antigen load so as to prevent the disease from progressing.

Certain attitudinal determinants such as alcohol consumption, poor adherence to intake of drugs, inaccessibility and high cost of antiviral drugs and viral load testing were observed. There are no causes other than poverty and inadequate guidance and counselling and hence the Government, hospitals and other regulatory bodies should be involved.

Another important determinant that was discovered was HIV co-infection. It was observed that most HIV co-infected patients had high viral load and this was due to immune suppression and drug resistance caused by HIV.
This implies that every hepatitis B patient should be screened for HIV since their transmission routes are similar. This will help in the reduction and management of Hepatitis B in Sub-Saharan Africa.

Finally with regards to Age, younger people were seen to have high levels of Hepatitis B surface antigens in Nigeria compared to the study done in Senegal which showed high levels in patients above 40 years. Nigeria and Senegal are both in West Africa and hence are expected to have similar results but their demographic characteristics are different which could attribute to this finding. For example the type of population used in the Senegal study involved more participants than the Nigerian study and hence more representative and accurate. The Nigerian Study involved patients who had chronic Hepatitis and hence could result in the high levels of viral load. Also one interesting factor which was observed was that contraction of Hepatitis B at an early age resulted in low hepatitis B viral load over time. Young children have a stronger immune system than adults and hence are able to fight the virus. Older people tend to have reduced immune function due to presence of other diseases and age.

5 Limitations
The sample sizes of all the literature gathered were not similar and hence could not give an accurate comparison in terms of results. Also since this review study focused on Sub-Saharan Africa, the literature gathered were not representative of all the cardinal points of the continent. Majority of the literature gathered were from West Africa and hence making derivations from this study to be used in other parts of the continent will not be accurate.

6 Conclusion
In conclusion, the findings of this review suggest that it is very important to know one's hepatitis B viral load status, antigen and antibody status. It is seen that there are limited resources and restricted access to drug resistance testing, hepatitis B genotype testing, guidance to provide enhanced adherence to drug intake counselling and support to patients. It is therefore recommended that Governmental institutions and policy makers should make it mandatory for genotype E testing since that is the type that has high viral loads according to this review study. Also, it is recommended to have mandatory HIV screening for all Hepatitis B positive patients and provide affordable antiviral drugs.

References
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