



Microbes and Infectious Diseases

Journal homepage: <https://mid.journals.ekb.eg/>

Systematic review and meta-analysis

Prevalence of hepatitis B virus among people in Somalia and among Somalian immigrants in diaspora: A systematic review and meta-analysis

Abdirasak Sharif Ali Mude*¹, Yahye Ahmed. Nageye¹, Kizito Eneye Bello²

1- Faculty of Medicine and Health Sciences, SIMAD University, Mogadishu, Somalia.

2- Department of Microbiology, Faculty of Natural Science, Kogi State (Prince Abubakar Audu) University, Anyigba. PMB 1008, Anyigba, Kogi State, Nigeria.

ARTICLE INFO

Article history:

Received 12 February 2024

Received in revised form 26 February 2024

Accepted 28 February 2024

Keywords:

Hepatitis B virus

Somalia

Somalians

Prevalence

Systematic review

Meta-analysis

ABSTRACT

Background: The burden of the hepatitis B virus in Somalia is of epidemiological significance. This study aims to assess the prevalence of hepatitis B virus (HBV) among the population of Somalia and Somalian immigrants in the diaspora by a systematic review and meta-analysis. **Method:** A comprehensive search of literature detailing the frequency of HBV among individuals residing in Somalia and among Somalian immigrants was carried out in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) criteria. The meta-analysis was conducted using a single-arm random effects model, employing the DerSimonian and Laird technique. **Result:** Our search yielded 24 relevant publications encompassing 9976 cases of HBV in Somalia and among Somali immigrants in the diaspora. The prevalence of HBV among those residing only in Somalia was significantly higher (20.9% (CI: 15.2 – 28.1, I² = 97.19%, $p < 0.001$) compared to the overall prevalence among Somalian immigrants and individuals living in Somalia (17.5% (CI: 13.0 – 23.5, I² = 97.11%, $p < 0.001$). The prevalence of HBV among Somalian immigrants in the diaspora group was found to be the lowest, with an incidence of 6.9% (CI: 3.7 – 12.3, I² = 92.81%, $p < 0.001$). The coexistence of various medical conditions (Diabetes, hypertension, and Schistosomiasis) exhibited a strong correlation with the development of HBV in Somalia and among individuals who have immigrated from Somalia. **Conclusion:** The study provides evidence indicating that the overall prevalence of HBV among Somalians was rather high on a global scale (17.5%), with a greater prevalence observed among those residing in Somalia (20.9%).

Introduction

The infection caused by the hepatitis B virus (HBV) continues to pose a significant threat to public health on a global scale [1]. The incidence of Hepatitis B in Asia and Africa is on the rise despite vaccine intervention placing a considerable strain on healthcare systems and impacting millions of people around the world [1]. Understanding the incidence of HBV in Somalia is crucial for

developing and implementing effective control strategies, given the country's intricate combination of socio-economic, political, and environmental elements [2].

Somalia, situated in the Horn of Africa, confronts a multitude of health adversities, notably infectious ailments such as hepatitis B [3]. Decades of conflict and instability have greatly affected the country's health infrastructure, resulting in restricted

DOI: 10.21608/MID.2024.269809.1799

* Corresponding author: Abdirasak Sharif Ali Mude

E-mail address: arshamyare@gmail.com

© 2020 The author (s). Published by Zagazig University. This is an open access article under the CC BY 4.0 license <https://creativecommons.org/licenses/by/4.0/>.

availability of healthcare services and insufficient disease tracking systems. Furthermore, socio-economic variables such as poverty, unemployment, and food insecurity augment the susceptibility of the population to viral diseases, including HBV [4]. However, there is a lack of reliable data regarding the extent and geographic spread of HBV infection in various parts of Somalia [5].

The research holds great importance as it can provide valuable insights for evidence-based interventions and policies that aim to alleviate the impact of HBV in Somalia. This analysis will enable them to create specific policies for controlling and preventing HBV in Somalia, considering the distinct socio-cultural factors [6], [7]. Furthermore, the knowledge acquired from this study could aid in identifying populations at greater risk and in establishing efficient screening and vaccination initiatives to reduce the spread of HBV in the community [8].

This study aims to fill this gap in knowledge by conducting a comprehensive assessment of existing literature and conducting a meta-analysis to consolidate the available data on the prevalence of HBV in Somalia. This study seeks to analyze existing evidence and identify areas of knowledge that are lacking. Its objective is to offer valuable insights that can inform public health initiatives and help decrease the occurrence of HBV-related illness and death in Somalia.

This systematic review and meta-analysis will give sufficient information on the pool prevalence of HBV in Somalia. Despite the surveillance in several African countries [7], [8], the pooled prevalence of HBV is yet to be reported in Malaysia, and this study provides adequate information.

Methods

To ensure a comprehensive assessment without duplicating existing material or active projects, we conducted an initial search for key terms in two review databases, PROSPERO and DARE. We performed an extensive search on four widely recognized international electronic databases, including PubMed, Scopus, Science Direct, and Google Scholar. Our search followed the preferred reporting items for systematic reviews and meta-analysis guidelines to ensure a thorough and reliable synthesis of information [9]. We were searching for literature regarding the frequency of HBV in Somalia. We employed diverse search

methodologies, encompassing key terms such as "Hepatitis B" OR "HBV" and an exhaustive compilation of cities in Somalia. To expand the range of our search, we employed abbreviations such as "HBV," alternative keywords like "Liver cancer," and Boolean operators when necessary. To confirm the validity of our findings, we conducted a comprehensive search that was not restricted to language or publication year. The details of the search strategies employed in the four electronic databases can be found in **supplemental file (B1)**. The most recent search was conducted on February 02, 2024.

The search results obtained from many databases were integrated into the Mendeley desktop reference manager software, and any duplicate entries were eliminated.

Eligibility and data extraction

This review covered cross-sectional studies, prospective cohorts, and retrospective cohorts that had gathered HBV data from Somalia. The inclusion and exclusion process was conducted meticulously. To eliminate repetition and unnecessary repetition, we excluded studies that consisted of review papers, editorials, case reports, brief communications, conference proceedings, and articles lacking clearly defined sample sources and origins. Furthermore, we excluded studies that were not retrievable in their whole or had redundant or duplicated data.

Three authors (KEB, ASAM, and YAN) conducted separate evaluations of each title, abstract, and full-text submission, adhering to the inclusion criteria in order to maintain the utmost objectivity and clarity. In the event of any differences, they were handled through consensus among the writers.

We conducted a comprehensive examination of the complete texts, abstracts, and titles of the relevant papers that met our criteria. The pertinent data was extracted and organized into a systematic proforma, encompassing the authors' names, publication year, country, and study designs. The data was collected by three authors (KEB, ASAM, and YAN) to ensure the accuracy and comprehensiveness of the analysis.

Statistical analysis and quality assessment

In our research, we employed a single-arm random-effects model to determine the combined prevalence of HBV in Somalia. To accomplish this purpose, the DerSimonian and Laird meta-analysis

approach, which is included in the OpenMeta and comprehensive meta-analysis software, was employed [10] – [12]. We employed a funnel plot to quantify the bias in publication. The Cochran's Q test was utilized to evaluate the heterogeneities of subgroup estimations. The heterogeneity index was calculated using the Cochran Q test and I^2 values, as per statistical analysis [3]. For instance, an I^2 score of 25%, 50%, and 75% corresponded to low, moderate, and high degrees of heterogeneity, respectively [13]. We conducted a subgroup analysis to determine the prevalence of HBV among different nationalities and types of studies to gain further insights. This subgroup analysis was conducted using open meta analyst version 10.10.

HBV prevalence data in Somalia were collected and analyzed using descriptive statistics. In each test, a p -value below 0.001 was statistically significant. To ensure the general quality of the included studies, we employed the Joanna Briggs Institute (JBI) critical assessment checklist for prevalence statistics (**Supplementary file B2**) [14] – [15]. Three authors meticulously analyzed the investigations conducted by KEB, ASAM, and YAN. Each study was assigned a score of "2" for "yes" and "0" for "no" to establish a quality score ranging from 0 to 18. Studies with a quality score ranging from 14 to 18 were considered satisfactory.

The analysis was conducted using the PRISMA protocol (**Supplementary file B3**).

Result

Search results and eligible studies

Our comprehensive search methodology yielded an initial retrieval of 3289 abstracts from four prestigious international electronic databases. Through meticulous scrutiny, we thoroughly analyzed each record and eliminated any instances of duplication, resulting in a meticulously chosen assortment of precisely 2138 articles. Following further scrutiny of titles and abstracts, a total of 1776 items were excluded, resulting in 362 papers remaining for a thorough examination of the complete text. Nevertheless, a total of 338 publications were deemed ineligible during the review phase due to their failure to meet our rigorous inclusion criteria or receiving a low assessment score as per the JBI assessment standards. **Figure 1** depicts a comprehensive illustration of the selection process. Ultimately, a total of 24 articles were examined, encompassing

9976 individuals diagnosed with HBV and cases in Somalia.

Characteristics of the eligible studies

Table 1 provides a thorough summary of research investigating the occurrence of HBV within the Somali population. The included articles were published from 1977 – 2021. The study was based on different factors, including authors, sample size, number of individuals positive and negative for HBsAg (Hepatitis B surface antigen), study location, study type, population characteristics, study cohort, presence of multiple sexual partners, age range, and related comorbidities. Various research undertaken in Italy ($n = 2$), the United States ($n = 1$), the United Kingdom ($n = 1$), and Somalia have provided insights into the prevalence of HBV among the Somali people.

Most of the articles included in this study were carried out in Somalia ($n = 20$). This study differs in its techniques, encompassing cross-sectional and retrospective, and focuses on various target populations, including adults, children, pregnant women, and immigrants. There were more cross-sectional studies than retrospective study designs in this study. Prominent discoveries encompass a variety of cases where HBsAg tested positive in various studies, with certain cases suggesting the coexistence of comorbidities such as diabetes, hypertension, leprosy, and schistosomiasis among the affected individuals, as represented in **table (1)**.

Pooled prevalence of HBV among people living in Somalia and Somalian immigrants cohort

There was a high pooled prevalence of HBV among people living in Somalia and Somalians in the diaspora [17.5% CI: 13.0 – 23.5, $I^2 = 97.11\%$, $p < 0.001$]. The forest plot of all the pooled studies reveals the weight of the individual studies was from Somalia and the diaspora, as shown in **figure (2)**. The pooled prevalence of HBV in Somalia and among Somalians in the diaspora was statistically significant at $p < 0.001$. There was, however, a publication bias among the included studies, as shown in **figure (3)**. Egger's statistics were insignificant at $p = 0.00876$, as shown in **figure (3)**.

There was a significantly higher prevalence of HBV among people staying in Somalia than the entire Somalian cohort globally. The pooled prevalence of HBV in Somalia alone was 20.9% (CI: 15.2 – 28.1, $I^2 = 97.19\%$, $p < 0.001$)

(**Figure 4**). There was, however, no publication bias in the symmetry of the funnel plot, as shown in **figure (5)**. The pooled prevalence of HBV among Somalian immigrants in the diaspora was relatively low in comparison to the prevalence of HBV in people living in Somalia. A pooled prevalence of 6.9% (CI: 3.7 – 12.3, $I^2 = 92.81\%$, $p < 0.001$) was examined in this study for the Somalian immigrant cohorts in the diaspora (**Figure 6**). Despite the low pooled prevalence of HBV among Somalians in the diaspora, there was high heterogeneity (92.81%) among the included studies in this category. There was, however, a bias in the publication, as shown in the asymmetry pattern of the included studies in this category, as shown in **figure (7)**.

Subgroup meta-analysis of HBV prevalence in Somalia and among Somali in diaspora

Table 2 presents a subgroup meta-analysis that specifically examines the prevalence of HBV among the Somali population, both within Somalia and in diaspora. The analysis considers various factors such as the source of the sample, study designs, study cohort, multiple sexual partners, population type, and associated comorbidities. Where variable queries were not applicable in the study, such studies were not included in the subgroup meta-analysis of that variable category. In Italy, the prevalence of the condition is 4.9% with a 95% confidence interval ranging from 2.7% to 8.8%. There is moderate heterogeneity, indicated by an I^2 value of 58.86. Somalia has a prevalence rate of 20.9% (95% CI: 15.2 – 28.1), indicating a substantial level of variation ($I^2 = 97.19$). The prevalence of 13.6% and 5.7% has been separately observed in investigations conducted in the United States and the United Kingdom, respectively. There

were 19 articles with cross-sectional designs, with a prevalence rate of 19.3% (95% CI: 13.0 – 27.7). The studies showed a significant level of heterogeneity as represented in **table (2)**.

There were 5 retrospective investigations conducted, which found a prevalence rate of 11.7% (95% confidence interval: 8.4 – 16.0). A total of 18 studies from an adult cohort, with a prevalence rate of 17.7% (95% CI: 12.1 – 25.2). There were four studies from the children cohort, with a prevalence rate of 18.5% (95% CI: 12.1 – 25.2). Two studies however were from the pregnant cohort with a reported a prevalence rate of 13.8% (95% CI: 4.8 – 33.6), with a substantial level of heterogeneity identified ($I^2 = 97.06$). The prevalence of having numerous sexual partners was found to be 9.4% (95% CI: 4.9 – 17.4) as presented in **table (2)**.

The prevalence of HBV among individuals who do not have several sexual partners was found to be 19.2% (95% CI: 12.0 – 29.3) based on 9 studies. There was however high heterogeneity observed among the studies ($I^2 = 96.47$), as represented in **table (2)**.

Somali immigrant's HBV prevalence in Diaspora was relatively in this study, a prevalence rate of 6.7% (95% CI: 3.5 – 12.3) in comparison to the local population with a prevalence of 20.9% (95% CI: 15.2 – 28.1). The presence of other comorbidities was significant in this study, however there was no heterogeneity in people how reported to have been concurrently infected with HBV and leprosy in this study. Diabetes had a prevalence of 8.7% and hypertension had a prevalence of 31.2%, as presented in **table (2)**.

Table 1. Characteristic of the eligible studies showing the prevalence of HBV in Somalia/Somali population.

Name of authors	Publication year	Total	HBsAg positive	HBsAg Negative	Nature of study/source of sample	Population	Type of study	Study cohort	Multiple sexual partners	Age range	Age range	Associated comorbidity
Padovese et al [16]	2014	500	31	469	Italy	Immigrants	Cross-sectional	Adult	Yes	NA	NA	Diabetes
Kadle et al [17]	2012	156	61	95	Somalia	Local	Cross-sectional	Adult	No	NA	NA	NA
Shire et al [18]	2012	1109	151	958	United States	Immigrants	Retrospective	Adult	Yes	NA	NA	NA
Khadjio [19]	2011	147	59	88	Somalia	Local	Cross-sectional	Adult	No	NA	NA	NA
Aweis et al [20]	2001	439	25	414	United Kingdom	Immigrants	Cross-sectional	Adult	NA	NA	NA	NA
Nur et al [21]	2000	198	34	164	Somalia	Local	Cross-sectional	children	No	NA	NA	Hypertension
Faustini et al [22]	1994	213	7	206	Italy	Immigrants	Cross-sectional	Adult	No	NA	NA	NA
Bile et al (a) [23]	1992	596	95	501	Somalia	Local	Cross-sectional	children	NA	1 - 017	10.4	Leprosy
Mohamud et al [24]	1992	1272	134	1138	Somalia	Local	Retrospective	Adult	No	NA	NA	NA
Bile et al (b) [25]	1991	232	67	165	Somalia	Local	Cross-sectional	children	No	NA	NA	NA
Aceti et al (a) [26]	1989	1138	220	918	Somalia	Local	Retrospective	Adult	NA	NA	NA	NA
Bile et al (c) [27]	1991	158	3	155	Somalia	Local	Cross-sectional	Adult	Yes	18 - 80	34.2	Diabetes
Aceti et al (b) [28]	1991	104	52	52	Somalia	Local	Cross-sectional	Adult	NA	NA	NA	Hypertension
Jama et al [29]	1987	218	49	169	Somalia	Local	Cross-sectional	Pregnant women	Yes	NA	NA	NA
Bile et al (d) [30]	1987	946	78	868	Somalia	Local	Retrospective	Pregnant women	NA	18 - 50	29.7	NA
Sebastiani et al (a) [31]	1985	383	46	337	Somalia	Local	Cross-sectional	Adult	No	NA	NA	NA
Nuti et al (a) [32]	1979	102	49	58	Somalia	Local	Cross-sectional	Adult	NA	NA	NA	Schistosomiasis
Nuti et al (b) [33]	1979	157	22	135	Somalia	Local	Cross-sectional	Adult	No	NA	NA	Leprosy
Nuti et al (c) [34]	1978	101	24	77	Somalia	Local	Cross-sectional	Adult	NA	NA	NA	Schistosomiasis
Nuti et al (d) [35]	1979	222	80	142	Somalia	Local	Cross-sectional	Adult	No	NA	NA	Diabetes
Delia et al [36]	1977	155	118	37	Somalia	Local	Cross-sectional	Adult	NA	NA	NA	Schistosomiasis
Sebastiani et al (b) [37]	1984	86	11	75	Somalia	Local	Cross-sectional	Children	NA	18 - 80	34.1	NA
Eneh et al [38]	2021	1124	101	1023	Somalia	Local	Retrospective	Adult	NA	NA	NA	NA
Mohamed et al [39]	2021	220	16	204	Somalia	Local	Cross-sectional	Adult	NA	18-90	52.7	NA

Key: NA-Not applicable

Table 2. Subgroup meta-analysis of the prevalence of HBV among Somali population in Somalia and in diaspora in relation to the source of sample, study designs, study cohort, multiple sexual partner, population type and associated comorbidities.

Variable	Number of studies	Prevalence (%)	95% CI	Q	Heterogeneity test		I ² (%)
					DF	P	
Source of sample							
Italy	2	4.9	2.7 – 8.8	2.431	1	0.119	58.86
Somalia	20	20.9	15.2 – 28.1	676.257	19	<0.001	97.19
United States	1	13.6	11.7 – 15.8	-	-	-	-
United Kingdom	1	5.7	3.9 -8.3	-	-	-	-
Study design							
Cross-sectional	19	19.3	13.0 – 27.7	562.083	18	<0.001	96.8
Retrospective	5	11.7	8.4 – 16.0	80.819	4	<0.001	95.05
Study cohort							
Adult	18	17.7	12.1 – 25.2	717.893	17	<0.001	97.63
Children	4	18.5	12.1 – 25.2	20.499	3	<0.001	85.37
Pregnant women	2	13.8	4.8 – 33.6	34.051	1	<0.001	97.06
Multiple sexual partners							
Yes	4	9.4	4.9 – 17.4	48.673	3	<0.001	93.84
No	9	19.2	12.0 -29.3	226.480	8	<0.001	96.47
Population type							
Immigrants	4	6.7	3.5 – 12.3	41.714	3	<0.001	92.81
Local	20	20.9	15.2 – 28.1	676.257	19	<0.001	97.19
Associated comorbidities							
Diabetes	3	8.7	1.5 – 37.1	104.248	2	<0.001	98.08
Hypertension	2	31.2	8.9 – 68.0	33.472	1	<0.001	97.01
Leprosy	2	15.6	13.1 – 18.3	0.351	1	0.554	0.00
Schistosomiasis	3	49.4	21.1 – 78.1	61.696	2	<0.001	96.76

Key: - P, probability value; DF, Degree of freedom; I², Heterogeneity index; Q, correlation

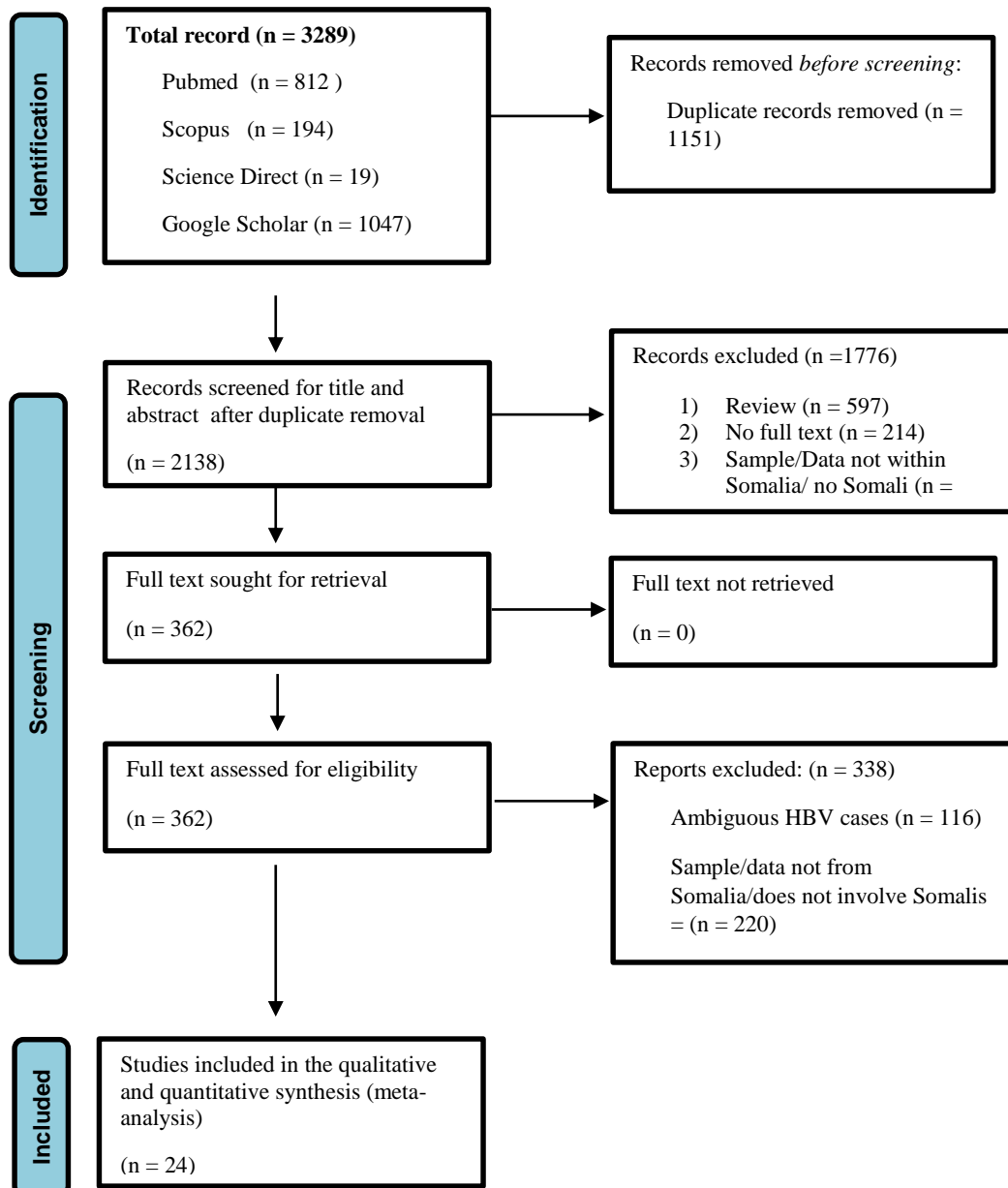
Figure 1. Summary of the article selection process.

Figure 2. Forest Plot showing the pooled prevalence of HBV among people living in Somalia and Somalian immigrants cohort.

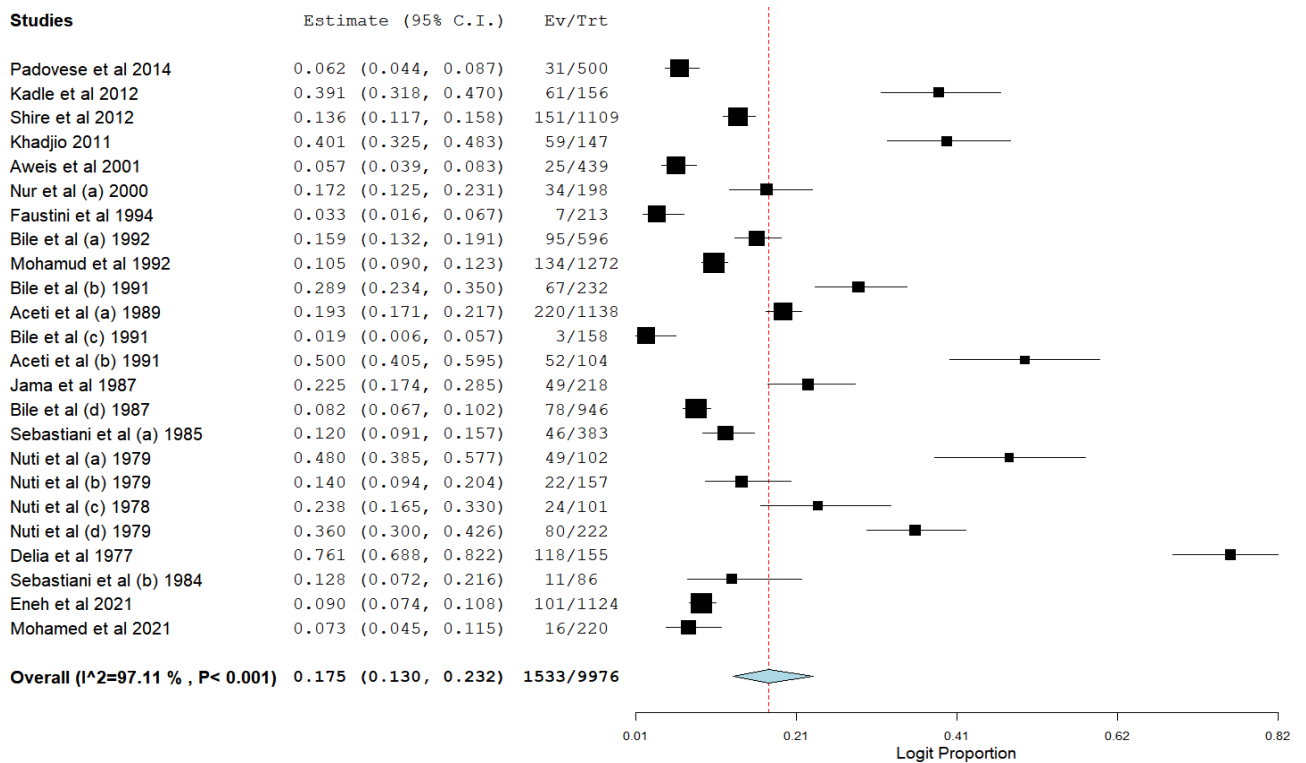
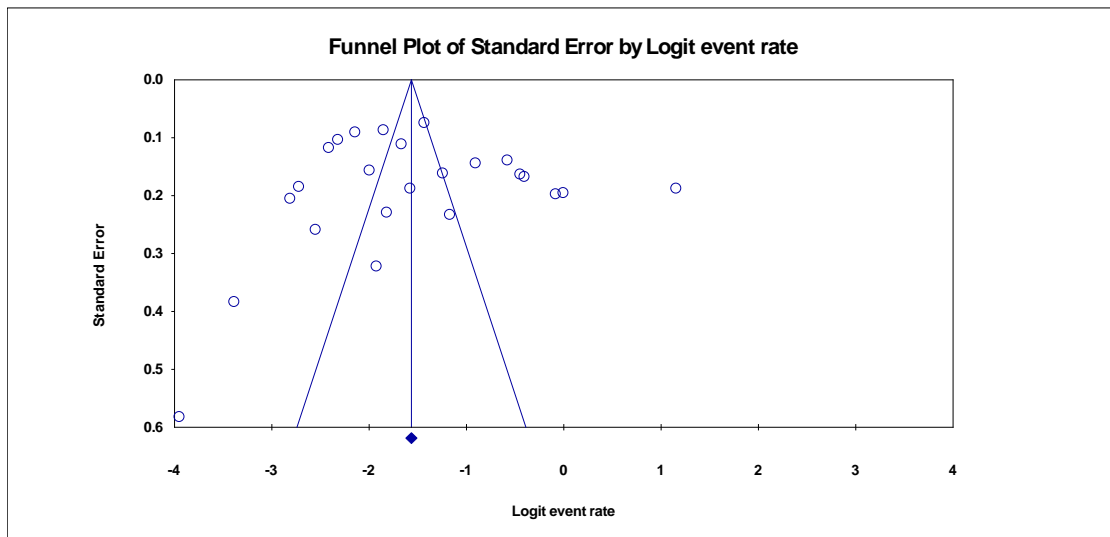


Figure 3. Funnel plot showing publication bias of the pooled prevalence of HBV among the Somalian population in Somalia and the diaspora



Egger $p = 0.2932$

Figure 4. Forest plot showing the pooled prevalence of HBV in Somalia.

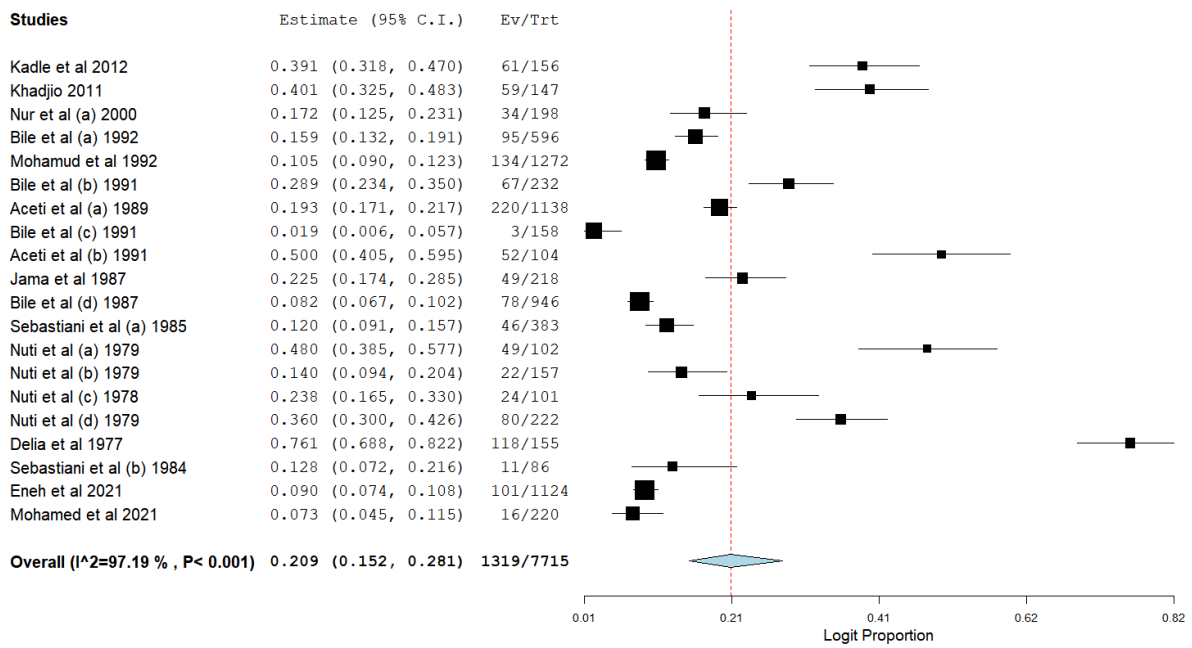
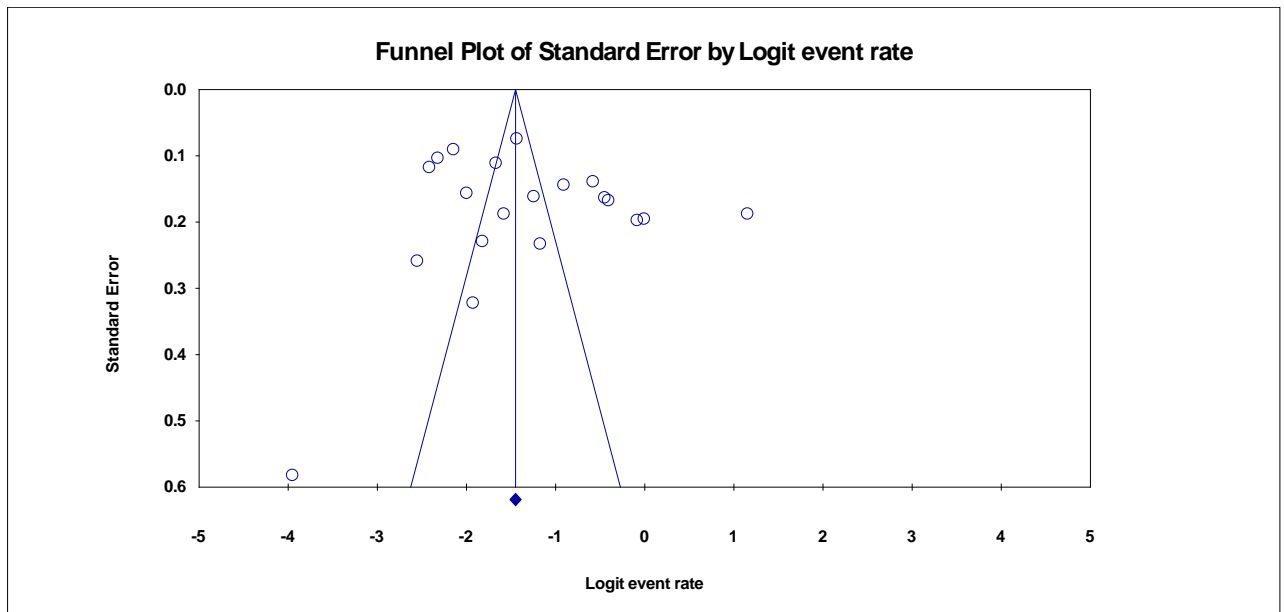
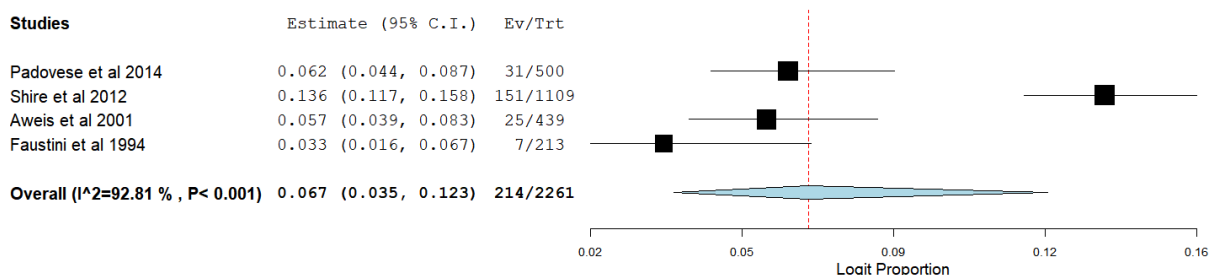
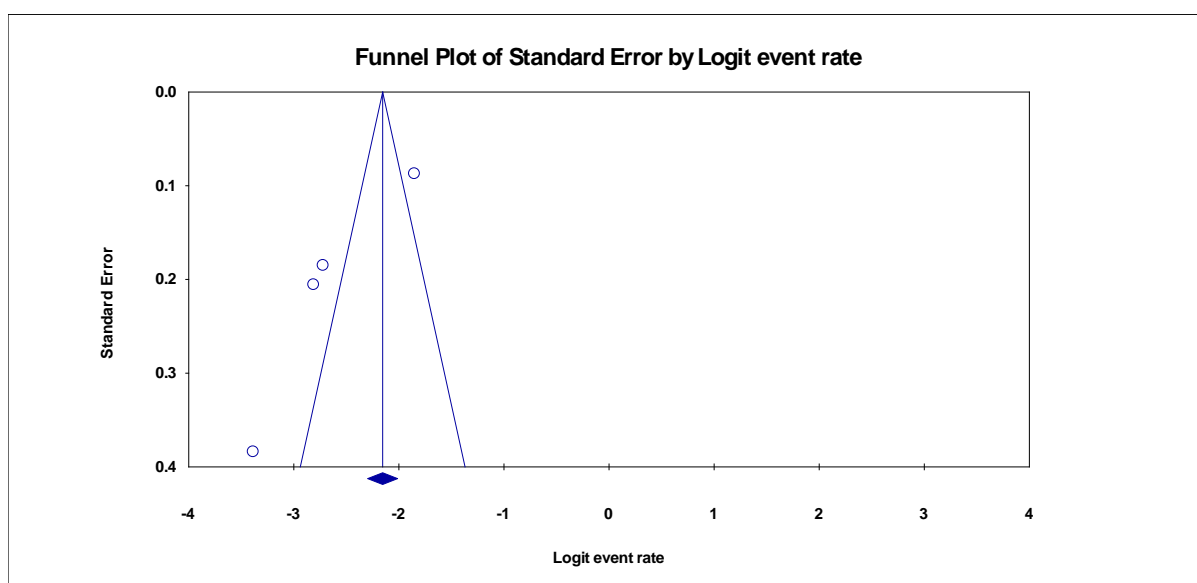


Figure 5. Funnel plot showing publication bias of the pooled prevalence of HBV in Somalia.



Egger's $p = 0.1314$

Figure 6. Forest plot showing the pooled prevalence of HBV among Somali immigrants in the diaspora.**Figure 7.** Funnel plot showing Publication bias of the pooled prevalence of HBV among Somalians in the diaspora.

Egger's $p = 0.0189$

Discussion

The incidence of hepatitis B infection and other emerging diseases in developing nations over the past decade are of epidemiological significance [10]. Hepatitis B mortality rate in Somalia was approximately 4.3% [14]. The introduction of the HBV neonatal vaccine in the late 1990s did not affect the morbidity of the disease in Africa [14], [34] – [36]. The national burden of HBV in Somalia is very high. Despite the intervention of the government and non-governmental agencies in the provision of adequate awareness for the prevention and management of the disease, the associated morbidity of HBV among Somalians is still of public health concern [13] – [17].

Knowledge of the overall pooled prevalence of HBV in People living in Somalia and

among Somalians in the diaspora will help facilitate strategic approaches toward geographically oriented prevention and management of the disease [29].

This systematic review and meta-analysis is the first to report the pooled prevalence of HBV among people living in Somalia and among Somalians in the Diaspora. The study meticulously ensured the inclusion of pertinent and high-caliber literature were considered. The 24 included articles met all the designed criteria for inclusion in this, which are in alliance with the PRISMA recommendation and the JBI checklist [8]. The publications provided encompassed a time frame from 1977 to 2021 and exhibited diversity in terms of study design, sample size, geographic location, and population characteristics. A population of 9976

Somalians was considered for this study, displaying the robustness of this study.

The findings of this study make a substantial contribution to the comprehension of HBV epidemiology among Somalis. It enhances our understanding of the disease burden in this specific community, going beyond previous research that has examined HBV prevalence in different populations, including immigrant communities.

Most of the study was from Somalia, thereby justifying the overall burden of HBV among the residents of the community. The latter complies with the report of **Irekeola et al.** where they presented that the burden of disease is correlated to the population of the study area [15].

There were significant differences in the prevalence of HBV in Somalia in relation to different study cohorts in this study. Most of the study participants were adults; the probable reason for the latter is unclear, but it could be attributed to the higher predisposing risk factors towards the acquisition of HBV among adults. Such conditions include but are not limited to unprotected sexual intercourse, use and sharing of sharp objects, intravenous drug usage and the presence of multiple sexual partners. The findings of this study comply with the report of others [16]–[19].

The variety of study designs and demographic cohorts enhances the depth and intricacy of the results. Furthermore, the incorporation of research carried out in additional nations like as Italy, the United States, and the United Kingdom provides a more comprehensive outlook on the frequency of HBV among the Somalis in the diaspora [19].

The combined occurrence of HBV among individuals living in Somalia and Somalis living abroad was significantly high. The latter shows a large burden of HBV within the Somali population, both domestically and globally. The high heterogeneity observed in this study shows that there was variation in the prevalence estimates among different study populations. The findings of this study are concordant with other reports [20], [21].

Despite the variation in characteristics and the high pooled prevalence, there was evidence of publication bias. Therefore, care should be taken in the interpretation of findings to avoid overestimation or underestimation of the actual prevalence of HBV in the population. The latter

complies with the report of **Bello et al.** [12]. An important pattern observed in the data is the difference in HBV prevalence between individuals living in Somalia and Somali immigrants living in other countries. More precisely, the occurrence of HBV was notably greater among individuals residing in Somalia in comparison to the overall Somali population worldwide. This discovery emphasizes the significance of taking into account geographical and environmental elements while comprehending the prevalence and transmission dynamics of diseases.

Moreover, the data indicated a reduced overall occurrence of HBV among Somali immigrants residing in other countries in comparison to persons residing in Somalia. Although the prevalence is lower compared to Somalia, the presence of substantial heterogeneity among the studies indicates that there is fluctuation in the prevalence of HBV among Somali immigrants in different countries. The findings of this study are in alliance with the reports of others [21]–[24]. The pooled prevalence of HBV in Somalia, in comparison to other sub-Saharan Africa, reveals a lower incidence of HBV among immigrants from sub-Saharan African nations. This difference is related to variations in healthcare availability, vaccine coverage, and cultural customs, which could affect the morbidity of the disease [22].

The analysis examines the correlation between HBV and other concurrent medical conditions, such as diabetes and hypertension [23]. Individuals with HBV exhibit a much-increased occurrence of diabetes and hypertension in comparison to the general population, suggesting the presence of potential synergistic effects between these ailments. In addition, the study identifies the simultaneous presence of leprosy and schistosomiasis infections, highlighting the significance of integrated healthcare strategies to tackle co-infections and comorbidities among susceptible populations [24].

The subgroup meta-analysis shows offers a detailed insight into the prevalence of HBV among the Somali population, both within Somalia and among Somali immigrants in different diaspora regions. The data shows significant variance in prevalence rates across different geographic areas. In Italy, the prevalence of HBV is 4.9%. However, in Somalia, it is substantially higher at 20.9%, showing a greater burden of HBV among the local Somali people. This discovery is consistent with the

concept that the prevalence of HBV might significantly differ depending on geographical and socioeconomic factors [25]. Notably, the prevalence rates in the United States and the United Kingdom are significantly lower, with 13.6% and 5.7% respectively. This suggests that there may be disparities in healthcare access, screening policies, or population demographics between the two countries. The findings of this study reveal age-specific prevalence rates, with adults exhibiting a prevalence of 17.7% in contrast to children at 18.5%. Pregnant women have a somewhat lower occurrence rate of 13.8%, which may be due to antenatal screening programs that try to reduce the transmission of HBV from mother to child. These findings emphasize the significance of taking demographic factors into account when evaluating the impact of diseases and developing focused therapies. The latter are in alliance with the reports of others [34] – [41].

Having several sexual partners is linked to a lower occurrence of HBV in this study, in contrast to persons who do not. The probable reason for the low incidence of HBV in relation to having multiple sexual partners is unclear. Still, it could be attributed to the behavior of the included individual and the high burden of religion among the participants [19].

Strength and limitations

This study is the first to report the pooled prevalence of HBV among Somalians in the diaspora and among people living within Somalia. The strength of this study lies in its thorough approach to combining existing literature and performing a meta-analysis to determine the prevalence of HBV in Somalia. The wide range of study types, sample sizes, and geographic areas offers a thorough and all-encompassing examination of the HBV epidemiology within the Somali population. Furthermore, the subgroup meta-analysis provides in-depth information regarding the occurrence rates among various demographic groups and geographical areas, hence enhancing our comprehension of the disease's impact. Although this study has notable merits, it is important to acknowledge some limitations that should be considered while evaluating its results. A few were studies reporting the prevalence of HBV among the Somali population in the diaspora, and there was also a publication bias in the study. Therefore, care should be taken when interpreting the findings of this study as it might not be the truest representation

of the HBV prevalence. Despite the above limitations, this study presents comprehensive epidemiological information on HBV in Somalia.

Conclusion

The pooled prevalence of HBV among Somalians was relatively high globally (17.5%) and higher among people living in Somalia (20.9%). This study offers unique insights into the epidemiological landscape of HBV, which can be used to develop focused prevention and treatment strategies to reduce the effect of the illness in Somalia and other Sub-Saharan Africa.

Supplementary materials

B1: PRISMA guideline.

B2: Search strategy of HBV prevalence in Somalia.

B3: JBI checklist for the prevalence data.

B4: Quality of included studies by JBI critical appraisal checklist for studies reporting prevalence data.

Author contributions

ASAM and KEB. Conceived and designed the study. Methodology: KEB, ASAM, and YAN select and assess the quality of studies. KEB and ASAM extracted and analyzed data. Analysis and writing: ASAM and KEB interpreted the results and drafted the manuscript. Writing review and editing: KEB, ASAM, and YAN reviewed and edited the manuscript. All authors have read and agreed to the published version of the manuscript.

Institutional review board statement

Not applicable.

Informed consent statement

Not applicable.

Data availability statement

The data presented in this study are available in the supplementary material.

Acknowledgments

The research team would like to acknowledge funding and support from the following sources:

Center for Research and Development, SIMAD University. Financial support for this study was provided by Center for Research and Development SIMAD University.

Conflict of interest

The authors declares no conflict of interest.

References

- 1-**Lavanchy D, Kane M.** Global Epidemiology of Hepatitis B Virus Infection. Published online 2016;187-20.
- 2-**Nuti M, Tarabini G, Palermo P, Tarabini GL, Thamer G.** Leprosy and hepatitis B virus markers: incidence of HBsAg and HBeAg in Somalian patients. *Int J Lepr Other Mycobact Dis* 1979;47(4):580-584.
- 3-**Kramvis A, Kew MC.** Epidemiology of hepatitis B virus in Africa, its genotypes and clinical associations of genotypes. *Hepatology Research*. 2007;37(SUPPL. 1).
- 4-**Lukhwareni A, Gededzha MP, Amponsah-Dacosta E, Blackard JT, Burnett RJ, Selable SG, Kyaw T, Mphahlele MJ.** Impact of lamivudine-based antiretroviral treatment on hepatitis B viremia in HIV-coinfected south africans. *Viruses* 2020;12(6). doi:10.3390/V12060634
- 5-**Mulders MN, Venard V, Njayou M, et al.** Low genetic diversity despite hyperendemicity of hepatitis B virus genotype E throughout West Africa. *Journal of Infectious Diseases* 2004;190(2):400-408.
- 6-**Duncan ME, Tibaux G, Pelzer A, et al.** A socioeconomic, clinical and serological study in an African City of prostitutes and women still married to their first husband. *Soc Sci Med*. 1994;39(3):323-333.
- 7-**Cooper PJ, Tomlinson M, Swartz L, et al.** Improving quality of mother-infant relationship and infant attachment in socioeconomically deprived community in South Africa: randomised controlled trial. *BMJ*. 2009;338:b974. doi:10.1136/bmj.b974
- 8-**Bello KE, Mat Jusoh TNA, Irekeola AA, et al.** A Recent Prevalence of Hepatitis B Virus (HBV) Genotypes and Subtypes in Asia: A Systematic Review and Meta-Analysis *Healthcare (Switzerland)* 2023;11(7).
- 9-**Liberati A, Altman DG, Tetzlaff J, et al.** The PRISMA statement for reporting systematic reviews and meta-analyses of studies that evaluate health care interventions: explanation and elaboration. *J Clin Epidemiol* 2009;62(10):e1-e34.
- 10-**George BJ, Aban IB.** An application of meta-analysis based on DerSimonian and Laird method. *Journal of Nuclear Cardiology* 2016;23(4):690-692.
- 11-**Barendregt JJ, Doi SA, Lee YY, Norman RE, Vos T.** Meta-analysis of prevalence. *J Epidemiol Community Health* (1978) 2013;67(11):974-978.
- 12-**Bello KE, Irekeola AA, Al-Mhanna SB, et al.** Prevalence of Spontaneous Bacterial Peritonitis (SBP) in Hepatitis B (HBV), and Hepatitis C (HCV) Liver Cirrhosis: A Systematic Review and Meta-Analysis. *Healthcare*. 2023;11(2):275.
- 13-**Hunter JP, Saratzis A, Sutton AJ, Boucher RH, Sayers RD, Bown MJ.** In meta-analyses of proportion studies, funnel plots were found to be an inaccurate method of assessing publication bias. *J Clin Epidemiol* 2014;67(8):897-903.
- 14-**Rabaan AA, Bello KE, Irekeola AA, et al.** Prevalence of Hepatocellular Carcinoma in Hepatitis B Population within Southeast Asia: A Systematic Review and Meta-Analysis of 39,050 Participants. *Pathogens* 2023;12(10).
- 15-**Dahie HA, Heyle AA.** Prevalence of Hepatitis B and Its Associated Factors Among Pregnant Women in Mogadishu, Somalia. *Archives of Business Research*. 2017;5(11):123-146.
- 16-**Padovese V, Egidi AM, Melillo TF, Farrugia B, Carabot P, Didero D, Costanzo G, Mirisola C.** Prevalence of latent tuberculosis,

- syphilis, hepatitis B and C among asylum seekers in Malta. *J Public Health (Oxf)* 2014; 36: 22-27 [PMID: 23559596 DOI: 10.1093/pubmed/fdt036]
- 17-Kadle M, Hassan AM, Yasin AM, Sheikh AH, Omar MS, Sayid AM.** Frequency of Hepatocellular Carcinoma and Its Associated of Hepatitis B and C in Patients Attending Mogadishu Hospitals. Accessed February 10, 2024. Available from: URL:https://www.researchgate.net/publication/309564485_Frequency_of_Hepatocellular_Carcinoma_and_its_associated_Hepatitis_B_and_C_in_Patients_attending_Mogadishu_hospitals
- 18-Shire AM, Sandhu DS, Kaiya JK, Oseini AM, Yang JD, Chaiteerakij R, et al.** Viral hepatitis among Somali immigrants in Minnesota: association of hepatitis C with hepatocellular carcinoma. *Mayo Clin Proc* 2012; 87: 17-24 [PMID: 22212964 DOI: 10.1016/j.mayocp.2011.08.001]
- 19-Olow KH, Warsame FS.** Prevalence of Liver Cirrhosis Post - Hepatitis B and C Among Adults in Mogadishu Hospitals. 2011
- 20-Aweis D, Brabin BJ, Beeching NJ, Bunn JE, Cooper C, Gardner K, Iriyagolle C, Hart CA.** Hepatitis B prevalence and risk factors for HBsAg carriage amongst Somali households in Liverpool. *Commun Dis Public Health* 2001; 4: 247-252 [PMID: 12109390]
- 21-Nur YA, Groen J, Elmi AM, Ott A, Osterhaus AD.** Prevalence of serum antibodies against bloodborne and sexually transmitted agents in selected groups in Somalia. *Epidemiol Infect* 2000; 124: 137-141 [PMID: 10722141 DOI: 10.1017/S0950268899003441]
- 22-Hassan YSA, Hassan SA, Ahmed NR.** Uptake of hepatitis B vaccination and associated factors among health sciences students, Mogadishu, Somalia. *Front Public Health*. 2023;11:1203519.
- 23-Bile K, Mohamud O, Aden C, Isse A, Norder H, Nilsson L, et al.** The risk for hepatitis A, B, and C at two institutions for children in Somalia with different socioeconomic conditions. *Am J Trop Med Hyg* 1992; 47: 357-364 [PMID: 1524149 DOI: 10.4269/ajtmh.1992.47.357]
- 24-Mohamud KB, Aceti A, Mohamed OM, Pennica A, Maalin KA, Biondi R, et al.** [The circulation of the hepatitis A and B viruses in the Somali population]. *Ann Ital Med Int* 1992; 7: 78-83 [PMID: 1334688]
- 25-Bile KM, Abdirahman M, Aden C, Norder H, Magnus L, Lindberg G, et al.** Minor role of hepatitis B virus in the causation of chronic liver disease in Somalia indicated by a case-control study. *Trans R Soc Trop Med Hyg* 1991; 85: 104-108 [PMID: 1712517 DOI: 10.1016/0035-9203(91)90177-Z]
- 26-Aceti A, Paparo BS, Celestino D, Pennica A, Caferro M, Grilli A, et al.** Seroepidemiology of hepatitis delta virus infection in Somalia. *Trans R Soc Trop Med Hyg* 1989; 83: 399-400 [PMID: 2617589 DOI: 10.1016/0035-9203(89)90516-6]
- 27-Bile K, Abdirahman M, Mohamud O, Aden C, Isse A, Nilsson L, et al.** Late seroconversion to hepatitis B in a Somali village indicates the important role of venereal transmission. *J Trop Med Hyg* 1991; 94: 367-373 [PMID: 1758006]
- 28-Aceti A, Mohamed OM, Paparo BS, Mohamud OM, Quaranta G, Maalin KA, et al.** High prevalence of anti-hepatitis delta virus antibody in chronic liver disease in Somalia. *Trans R Soc Trop Med Hyg* 1991; 85: 541-542

- [PMID: 1755067 DOI: 10.1016/ 0035-9203(91)90249-X]
- 29-Kolmos HJ, Zimakoff J.** [DASPID--an interdisciplinary Danish study group for the elucidation of peritonitis among peritoneal dialysis patients]. *Ugeskr Laeger* 1991; 153: 1068 [PMID: 2024336]
- 30-Bile KM, Aden A, Lindberg G, Nilsson L, Lidman K, Norder H, Magnius L.** Epidemiology of hepatitis B in Somalia: inference from a cross-sectional survey of serological markers. *Trans R Soc Trop Med Hyg* 1987; 81: 824-828 [PMID: 3502433 DOI: 10.1016/ 0035-9203(87)90043-5]
- 31-Sebastiani A, Aceti A, Paparo BS, Pennica A, Iardi I, Bile K, et al.** Hepatitis B virus circulation in three different villages of Somalia. *Trans R Soc Trop Med Hyg* 1985; 79: 162-164 [PMID: 4002285 DOI: 10.1016/0035-9203(85)90323-2]
- 32-Nuti M, Tarabini G, Palermo P, Tarabini GL, Thamer G.** Leprosy and hepatitis B virus markers: incidence of HBsAg and HBeAg in Somalian patients. *Int J Lepr Other Mycobact Dis* 1979; 47: 580-584 [PMID: 122628]
- 33-Nuti M, Harare O, Thamer G.** The surface antigen (HBsAg) and the e-antigen (HBeAg) in Somalian patients with acute viral hepatitis. *Trans R Soc Trop Med Hyg* 1979; 73: 185-187 [PMID: 473307 DOI: 10.1016/0035-9203(79)90207-4]
- 34-Nuti M, Abdullhai SE, Thamer G.** [E antigen (HBeAG) and surface antigen (HBsAg) in bladder schistosomiasis]. *Parassitologia* 1978; 20: 153-159 [PMID: 553266]
- 35-Nuti M, Abdullahi Elmi S, Alario C.** [Diffusion of hepatitis B surface antigens in subjects with bladder schistosomiasis]. *Boll Ist Sieroter Milan* 1979; 58: 220-223 [PMID: 518754]
- 36-Delia S, Nuti M, Soro S.** [Relations between hepatitis B surface antigen and parasitic diseases: observations in patients with ancylostomiasis and schistosomiasis]. *Quad Scavo Diagn* 1977; 13: 238-243 [PMID: 594309]
- 37-Sebastiani A, Aceti A, Russo V, Paparo BS, Pennica A, Bile K, et al.** Age-specific prevalence of hepatitis A and hepatitis B virus infection in fluvial Somalian village. *Estratto dal* 1984; 30: 17-23
- 38-Eneh PN, Mady M, Schmidt MA, et al.** Hepatitis B Screening of At-Risk Immigrants Seen at Primary Care Clinics: A Quality Improvement Project. *Mayo Clin Proc Innov Qual Outcomes*. 2021;5(3):635-644.
- 39-Jeele MOO, Addow ROB, Adan FN, Jimale LH.** Prevalence and Risk Factors Associated with Hepatitis B and Hepatitis C Infections among Patients Undergoing Hemodialysis: A Single-Centre Study in Somalia. *Int J Nephrol*. 2021;2021:1555775.
- 40-Brazhalovich FL, Klyuchnikov MI, Lukyanov AI.** The political-geographical aspects of problematic statehood (exemplified by Somalia). *Geography and Natural Resources*. 2016;37(3):264-270.
- 41-Klyuchnikov MI.** *Geography of Separatist Movements in Countries of Northeastern Africa*. Published online 2013.