



## Research article

Sero-prevalence and risk factors for hepatitis B virus infection among the consumers of the alcoholic beverage, *cheka* in Konso zone, southwestern EthiopiaBehailu Tsegaye<sup>a,\*</sup>, Eyayou Girma<sup>a</sup>, Tesfaye Kanko<sup>a</sup>, Tamiru Shibru<sup>b</sup>, Tadiwos Hailu<sup>b</sup>, Sntayehu Abebe<sup>c</sup>, Eshetu Zerihun<sup>c</sup>, Aseer Manilal<sup>d</sup>, Eskezyiaw Agedew<sup>e</sup><sup>a</sup> Department of Biomedical Sciences, College of Medicine and Health Science, School of Medicine, Arba Minch University, Arba Minch, Ethiopia<sup>b</sup> Department of Internal Medicine, College of Medicine and Health Science, School of Medicine, Arba Minch University, Arba Minch, Ethiopia<sup>c</sup> Department of Public Health, College of Medicine and Health Science, Arba Minch University, Arba Minch, Ethiopia<sup>d</sup> Department of Medical Laboratory Science, College of Medicine and Health Sciences, Arba Minch University, Arba Minch, Ethiopia<sup>e</sup> Department of Public Health, College of Medicine and Health Science, Debre Markos University, Debre Markos, Ethiopia

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## ABSTRACT

**Introduction:** Hepatitis B virus (HBV) is a hepatotropic and partially double stranded deoxyribonucleic acid (DNA) virus that causes the immune-mediated killing of infected liver cells. It is a public health conundrum due to its considerable morbidity and mortality. Cheka is a cereal and vegetable-based fermented beverage that is consumed as a key dietary component in the southwestern parts of Ethiopia. This study was aimed to assess the seroprevalence of hepatitis B surface antigen (HBsAg) and associated risk factors among cheka consumers in the Konso community, southwest of Ethiopia.

**Methods:** A community-based cross-sectional study was conducted in a total of 633 cheka consumers between October 01, 2018, and May 31, 2019. The socio-demographic characteristics and associated factors were collected using a pre-tested semi-structured questionnaire. HBV infection was screened using immune-chromatographic strip tests and positive results were further confirmed with ELISA.

**Results:** The prevalence of HBV was found to be 18.2% (95% CI, 15.1–21.5). Gender (male) (AOR = 1.757:95% CI, 1.009–3.059), age (35–44 yrs), (AOR = 4.123:95% CI, 1.718–9.892), nature of the job (daily laborer) (AOR = 4.551:95% CI, 1.115–18.57), awareness about the transmission of the disease (AOR = 2.056:95% CI, 1.074–3.934) and previous history of contacts with patients having liver diseases (AOR = 2.496:95% CI, 1.187–5.248) were identified as factors which are being significantly associated with the HBV infection.

**Conclusions:** Very high endemic levels of HBV infection are identified in the study. Male participants of age between 35 and 44 years, who are daily laborers and are aware of HBV transmission, with a previous history of contacts with patients having liver diseases were even at higher risk of HBV infection. The need for more research to find the links between cheka consumption and other mechanisms of HBV cross-infection in these communities is indicated.

## 1. Introduction

Hepatitis is a major public health conundrum that results in mortality and morbidity worldwide [1]. Hepatitis B virus is a hepatotropic DNA virus that causes the immune-mediated killing of infected liver cells [2]. It is an exclusive human virus that is mainly transmitted by blood transfusions, unsafe injection practices, tattooing, occupational hazards, sexual risk behaviors, or mother-to-child in the perinatal period [3]. It is

the most widespread and the most important type among hepatitis viruses [2]. Globally, 2 billion people are infected with HBV. The situation is more alarming in the developing world particularly in Asia and sub-Saharan Africa. Chronic infection with HBV could lead to cirrhosis (liver scarring), liver cancer, liver failure, and even death [4].

The prevalence of chronic HBV infection is categorized as high ( $\geq 8\%$ ), intermediate (2–8%), and low ( $< 2\%$ ) [5]. In developed countries, the incidence of hepatitis is around 0.1% whereas in developing countries it ranges from 3 to 20% and even higher in some areas [6]. In Ethiopia, the prevalence of hepatitis is high and it accounts for 12% of hospital admissions and 31% of mortality rate [7].

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HBV infection is a vaccine-preventable disease [8]. In Ethiopia, routine immunization was launched in the 1980s. Children under the age of one year are the target group for vaccination. There is no widely available treatment for chronic hepatitis B and other sequelae of HBV infections in the country, and even if they are available, the treatment cost falls on the individual patient [7].

Cheka is one of the cereals and vegetable-based fermented beverages that is consumed as the main drink in the south-western parts of Ethiopia, particularly in Dirashe and Konso zones. People of all ages including infants, pregnant and lactating women drink cheka [9]. Cheka is mainly prepared from cereals such as sorghum (*Sorghum bicolor*) and maize (*Zea mays*) and vegetables such as leafy cabbage (*Brassica* spp.), moringa, (*Moringa stenopetala*), root or leaf part of “taro”, and decne (*Leptadenia hastata*) [10]. It has high alcoholic content but is known to possess low nutritional value [11].

Heavy alcohol consumption can significantly enhance HBV replication, increase the oxidative stress and weaken the immune response, consequently playing an important role in the progression of liver disease to cirrhosis and, ultimately, in the development of hepatocellular carcinoma [12]. There exists no study set up on HBV infection among cheka consumers in the study area, and hence this work is aimed at assessing the prevalence and risk factors related to the Hepatitis B virus among cheka consumers in the Konso zone, southern Ethiopia.

## 2. Methods and materials

### 2.1. Study design and study setting

A community based cross-sectional study was designed and used to enroll 633 willing participants who consume cheka as the main drink associated with their diet between October 01 2018 and May 31, 2019. This study was carried out in the Konso zone which is located at 595 km away from Addis Ababa, the capital of Ethiopia. The zone has one district hospital and 9 health centers. The sample size was fixed by adopting the prevalence of HBV infection, i.e., 50%. After considering 95% of the confidence interval, 5% of marginal error, 10% of non-response rate, and 1.5 % of design effects due to multistage sampling, the final sample size was consolidated as 633.

### 2.2. Data collection and sample analysis

Socio-demographic characteristics and associated risk factors pertaining to the HBV infection were collected using a pretested and structured questionnaire by trained nursing professionals through a face-to-face interview (Tables S1,S2,S3). Following the interview, 5 ml of blood samples were taken from each participant by trained laboratory technicians. HBsAg was analyzed by using rapid test kits (Nantong Bio-Diagnos Biotechnology co., Ltd.P.R., China) following the manufacturer's instructions. The one-step HBsAg test is a chromatographic immunoassay in-vitro diagnostic test combined with conjugated colloid gold technology for the qualitative detection of Hepatitis B Surface antibody (HBsAg) in human serum/plasma specimen. As per the literature, sensitivity and specificity corresponds to 51.6% and 100% respectively [13]. The serum samples which were shown positive were then re-analyzed to inspect the consistency of results by using the ELISA test kit (DIALAB, Germany) that can identify all HBV genotypes and subtypes, for final confirmation. The sensitivity and specificity of the kit (performance) correspond to 99% and 100% respectively [7, 14, 15]. Samples found positive by the ELISA test only were reported as the final.

### 2.3. Data analysis

Data were entered into Epi Info version 3.5.1 and exported to SPSS version 21 for analysis. A descriptive analysis was conducted to describe the percentages and number of distributions of respondents based on socio-demographic characteristics and other relevant variables. Logistic

regression was used to fit the data to identify factors associated with HBV infection. The crude and adjusted odds ratio together with their corresponding 95% confidence intervals were computed. A p-value < 0.05 was considered as the standard to declare the statistical significance of a result.

### 2.4. Ethics approval and consent to participate

The study protocol was ethically approved by the review board of Arba Minch University, College of Medicine and Health Sciences. Informed written consent was obtained from each study participant, after the necessary explanation about the purpose, benefits, and risks of the study and also their right on the decision of participating in the study. Confidentiality was maintained at all levels of the study by giving unique code to each participant and by avoiding any personal identification.

## 3. Results

### 3.1. Socio-demographic characteristics

In this study, 633 individuals participated, out of which 122 were excluded due to inadequate information, leaving, a dataset with a total of 511 (80.7%) chronic cheka consumers and an analysis was made based on them. Total participants enrolled in the study comprised 264 (51.7%) males and 247 (48.3%) females, with a mean age of 35.94 years, dominantly within the age range of 25–34 (Table 1).

### 3.2. Distribution of Hepatitis B infection in selected Konso administrative unit

The spread of Hepatitis B infection varies in residents of the Konso zone and a high prevalence rate of HBV is observed in administrative units of Duritie and Jerso (Figure 1).

### 3.3. Sero-prevalence and associated factors with Hepatitis B infection

Among a total of 511 participants, 18.2% (n = 93) (95% CI, 15.1–21.5) were found to be positive for hepatitis B infection using the ELISA test as a reference. However, out of ninety-seven (97) samples found to be positive for HBV infection by the rapid HBsAg test, four were found negative by the ELISA test. Hepatitis B infection is four times more common among those participants aged between 35–44 years [AOR = 4.12; 95% CI (1.718, 9.892)], when compared to those aged 55 and above. More rural dwellers, 84 (19 %), were HBsAg positive than urban counterparts, 9 (13.5%). The prevalence rate was higher among males 54 (20.5%) than females 39 (15.8%) and the former were 1.7 times [AOR = 1.75; 95% CI (1.009, 3.059)] more prone to infection. In this study, the odds of having hepatitis B infection is 4.5 times and 2.4 times more common among participants who are daily laborers [AOR = [4.551, 95% CI = (1.115–18.57)] and among those who had contacts with a person having liver infection [AOR = 2.49; 95% CI (1.187, 5.248)] respectively. Study participants who had poor knowledge of HBV transmission were twice more likely to have an infection with HBV than those who have better awareness, [AOR = 2.056, 95% CI (1.074–3.934)] (Table 2).

## 4. Discussion

In this study, 93 (18.2%) of the participants were found to be infected with hepatitis B in the Konso zone where HBV infection has the status of an epidemic. In this study area, there, neither exists a routine vaccination, for the community nor for the health professionals. This could result in the transmission of the virus and an increased prevalence. Cheka is one of the indigenous low nutrient alcoholic drinks that are consumed without age restrictions in Konso [11]. It is a well-known fact that heavy consumption of alcohol like cheka significantly enhances the HBV replication, oxidative stress, risk of acquisition of new infections, along

**Table 1.** Socio-demographic characteristics of cheka consumers who participated in the study at Konso zone, Ethiopia, 2019 (n = 511).

Variables	Frequency	Percentage (%)
<b>Residence</b>		
Urban	444	86.9
Rural	67	13.1
<b>Sex</b>		
Male	264	51.7
Female	247	48.3
<b>Age</b>		
18–24	123	24.1
25–34	148	29.0
35–44	94	18.4
45–54	79	15.5
≥ 55	67	13.1
<b>Marital Status</b>		
Single	74	14.5
Married	414	81.0
Divorce	13	2.5
Widowed	7	1.4
Separated	3	0.6
<b>Educational level</b>		
Illiterate	299	58.5
Read only	36	7
Read and write	115	22.5
Primary school	33	6.5
Secondary and above	28	5.5
<b>Occupation</b>		
Farmer	405	79.3
Government	31	6.1
Student	27	5.3
Merchant	48	9.4

with weakness of immune response leading to the progression of chronic liver diseases [12].

The overall pooled report shows that the seroprevalence of hepatitis B virus in Ethiopia is 7.4% [16] and the prevalence of a community-based HBV study done in Gojjam, northwest Ethiopia corresponds to a value of 3.1% [17], both of which are lower than the percentages found in this study (18.2%). These differences might be due to the absence of vaccination, methods used for screening of HBsAg, lifestyle, and nutritional habits of individuals belonging to different study locations.

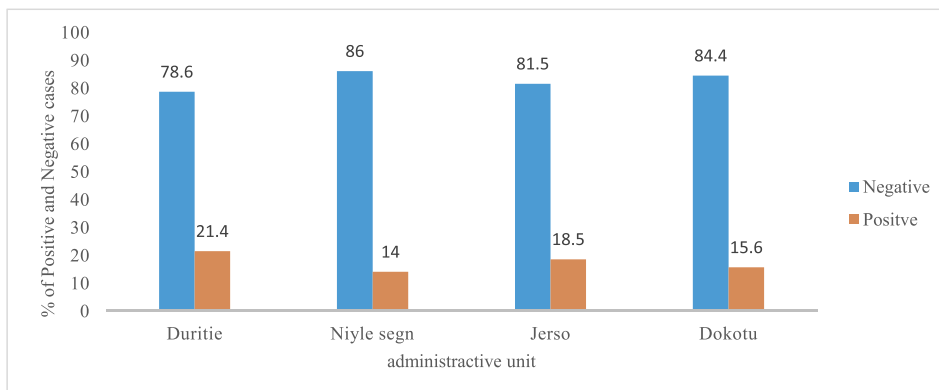
In multivariate analysis, it has been found that HBV infection is three times more common among the study participants between the age group

of 35–44 compared to those in the age group above 55. People in the former age group in the Konso community have greater exposures, more social interactions and they consume cheka regularly compared to their elderly counterparts. This may create an opportunity to facilitate the transmission of HBV in the community. This result is in line with the study performed in India, and Malaysia [3,18]. However, reports from different locales of the world indicate that aged individuals are at higher risk of getting HBV infection compared to younger participants [19,20]. According to this study, the odds of having HBV infection among those who had contacts with a liver infected person are almost three times higher compared to those who had no such contacts. HBV is transmitted through percutaneous or parenteral contact with infected blood, body fluids, and also via sexual intercourse. HBV can remain on any surface it comes in contact with for about a week, particularly on table-tops, razor blades, and bloodstains, without losing its infectivity [21]. This result is similar to the previous studies conducted in northwest Ethiopia and Nigeria [1, 22].

Males were twice likely to be positive for HBsAg than females. This is consistent with the findings from a couple of studies done in Ethiopia (Gondar and Jimma) as well as from northern India and Ghana [23, 24, 25, 26]. The increased risk of HBV infection in males may be attributed to the higher rate of extramarital sexual practices and a lower rate of HBsAg sero-clearance in comparison to females [26].

The odds of having HBV infection among daily laborers are four times more when compared to government workers. In Konso, the majority of daily laborers drink cheka as part of their daily diet, because it is inexpensive and also they assume that it can enhance their performance at work and may help for staying awake in activities [27]. Most of the daily laborers interact with one another when they consume cheka in groups, either by sharing it and or drinking together from the same vessels, expressing their intimacy and love. This may create an opportunity to facilitate the transmission of HBV. However, the results of this study are not in line with a couple of previous studies done in other regions of Ethiopia [28, 21].

To reduce HBV transmission among the community dwellers, deep knowledge and awareness about HBV are crucial. However, most of the participants 326 (71.9%) have only a poor knowledge and awareness on hepatitis B transmission. This situation is similar to that existing in the community of Malaysia were about 63.1 % of the participants had limited knowledge about HBV transmission [3]. It was found that most of the study participants were unable to read and write, showing a poor rate of literacy. This lower level of education could have an impact on the community, preventing them from having an easy access to information about HBV, from various sources. This is a major obstacle in implementing an effective healthcare practice and hence contribute to the continued spread of the infection [3, 29, 30].



**Figure 1.** Hepatitis B infection distributions in selected administrative units of Konso zone, southern Ethiopia, 2019.

**Table 2.** Bivariate and multivariate analyses showing factors associated with Hepatitis B infection, Konso zone, southern Ethiopia, 2019.

Variable	Category of variable	Hepatitis B status		COR (95%CI)	AOR (95%CI)	P-value
		Positive	Negative			
Residence	Rural	84 (19%)	360 (81%)	1.504 (0.717,3.156)	0.695 (0.292,1.653)	0.41
	Urban	9 (13.5%)	58 (86.5%)	1		
Sex	Male	54 (20.5%)	210 (79.5%)	1.371 (0.871, 2.16)	1.757 (1.009,3.059)	0.04**
	Female	39 (15.8%)	208 (84.2%)	1		
Age (years)	18–24	20 (16.3%)	103 (83.7%)	0.90 (0.396,2.062)	1.482 (0.574,3.829)	0.41
	25–34	21 (12.2%)	127 (85.8%)	1.061 (0.469,2.398)		
	35–44	33 (35.1%)	61 (64.9%)	0.34 (0.147,0.718)		
	45–54	9 (11.4%)	70 (88.6%)	1.365 (0.519,3.585)		
	≥55	10 (15%)	57 (85%)	1		
Education	Illiterates	66 (19.8%)	269 (80.2%)	0.679 (0.228,2.025)	0.795 (0.43,1.471)	0.46
	Elementary	23 (15.6%)	125 (84.4%)	0.906 (0.287,2.855)		
	Secondary and above	4 (14.3%)	24 (85.7%)	1		
Occupation	Farmer	72 (17.8%)	333 (82.2%)	1.266 (0.546,2.937)	1.289 (0.415,4.002)	0.66
	Merchant	7 (14.6%)	41 (85.4%)	0.368 (0.162,0.836)		
	Daily Laborer	10 (37.1%)	17 (62.9%)	1.459 (0.495,4.3)		
	Government	4 (13%)	27 (87%)	1		
Wealth index	Poorest	19 (17.8%)	88 (82.2%)	0.723 (0.366,1.427)	1.812 (0.849,3.866)	0.12
	Poor	23 (23%)	77 (77%)	1.168 (0.571,2.392)		
	Medium	17 (15.6%)	92 (84.4%)	0.943 (0.467,1.905)		
	Rich	19 (18.7%)	83 (81.3%)	1.123 (0.534,2.359)		
	Richest	15 (16.2%)	78 (83.8%)	1		
Marital status	Single	13 (17.6%)	61 (82.4%)	1	1.203 (0.305,4.748)	0.79
	Divorced/Widowed	4 (17.4%)	19 (82.6%)	1.055 (0.552,2.018)		
	Married	76 (18.4%)	338 (81.6%)	1.068 (0.353,3.230)		
Number of sexual partners	≥2 partners	17 (18.5%)	75 (81.5%)	0.978 (0.546,1.75)	0.942 (0.486,1.828)	0.93
	Single partner	76 (18.2%)	343 (81.8%)	1		
Alcohol drinking	Yes	52 (89.6%)	6 (10.4%)	0.971 (0.435,2.168)	1.22 (0.49, 3.01)	0.67
	No	416 (91.8%)	37 (8.2%)	1		
Unsafe abortion	Yes	5 (14.8%)	29 (85.2%)	0.762 (0.287,2.024)	1.225 (0.407,3.686)	0.71
	No	88 (18.5%)	389 (81.5%)	1		
Hospital admission	Yes	28 (17.4%)	133 (82.6%)	0.923 (0.566,1.505)	1.041 (0.587,1.846)	0.89
	No	65 (18.6%)	285 (81.4%)	1		
Skin tattooing	Yes	9 (9.7%)	44 (10.5%)	0.91 (0.43,1.94)	1.55 (0.62, 3.84)	0.35
	No	84 (90.3%)	374 (89.5%)	1		
Teeth extraction	Yes	26 (28.0%)	91 (21.8%)	1.39 (0.84, 2.32)	0.78 (0.45,1.39)	0.40
	No	67 (72.0%)	327 (78.2%)	1		
History of surgery	Yes	7 (7.5%)	25 (6.0%)	1.28 (0.54, 3.05)	0.55 (0.19, 1.57)	0.26
	No	86 (92.5%)	393 (94.0%)	1		
History of Blood Transfusion	Yes	2 (2.2%)	22 (5.3%)	0.39 (0.09,1.71)	3.15 (0.63, 15.77)	0.16
	No	91 (97.8%)	396 (94.7%)	1		
Contact with liver disease patients	Yes	16 (27.6%)	42 (72.4%)	2 (0.995,3.478)	2.496 (1.187,5.248)	0.01**
	No	77 (17%)	376 (83%)	1		
Awareness of HBV transmission	Good	41 (70.6%)	17 (29.4%)	1	2.056 (1.074,3.934)	0.03 **
	Poor	326 (71.9%)	127 (28.1%)	1.54 (0.89,2.63)		
Awareness of HB virus prevention	Good	24 (41.4%)	34 (58.6%)	1	1.155 (1.337,0.556)	3.21
	Poor	286 (63.1%)	167 (36.9%)	1.155 (0.725,1.838)		

Note: COR: Crude Odds Ratio; AOR: Adjusted Odds Ratio; \*\*significant at p-value < 0.05.

## 5. Conclusion

This study revealed that there is a higher endemic level of HBV infection, indicating an enhanced prevalence among males who are consumers of cheka. HBV infection is more common among the study participants who have a history of contacts with patients having liver diseases and they are individuals with poor knowledge and awareness on Hepatitis B transmission, and are also daily laborers who were at higher risk (especially in the age group between 35 and 44). Thus, the findings

of this study show a need for providing health education to the community, vaccination for high-risk population groups, and also guidance to improve the behavioral changes which can reduce the transmission of HBV in the Konso zone.

### 5.1. Limitations of the study

Molecular diagnosis of HBV and viral load assays were not performed due to a lack of laboratory set up. Additionally, this study did not

determine other blood-borne hepatitis viruses like Hepatitis C and D. The total sample size determined was 633, however, due to lack of adequate information, the study was finally concluded with 511.

## Declarations

### Author contribution statement

B. Tsegaye and E. Girma: Conceived and designed the experiments; Performed the experiments; Wrote the paper.

E. Agedew and E. Zerihun: Conceived and designed the experiments; Analyzed and interpreted the data; Wrote the paper.

T. Kanko and T. Hailu: Performed the experiments; Contributed reagents, materials, analysis tools or data; Wrote the paper.

A. Manilal: Performed the experiments; Analyzed and interpreted the data; Wrote the paper.

S. Abebe and T. Shibru: Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

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### Data availability statement

Data will be made available on request.

### Declaration of interests statement

The authors declare no conflict of interest.

### Additional information

Supplementary content related to this article has been published online at <https://doi.org/10.1016/j.heliyon.2020.e05664>.

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