Community-based sero-prevalence of hepatitis B and C infections in South Omo Zone, Southern Ethiopia

Adugna Endale Woldegiorgis, Woldearegay Erku, Girmay Medhin, Nega Berhe, Mengistu Legesse

1 Department of Pathobiology, Addis Ababa University, Addis Ababa, Ethiopia, 2 School of Medicine, College of Medicine and Health Sciences, Dire Dawa University, Dire Dawa, Ethiopia, 3 Department of Microbiology, Immunology and Parasitology, School of Medicine, College of Health Sciences, Tikur Anbessa Hospital, Addis Ababa University, Addis Ababa, Ethiopia

* adugna.endale@aau.edu.et

Abstract

Background
Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) are the leading causes of liver-related morbidity and mortality throughout the world. The magnitude of HBV and HCV infections in Ethiopia has not been well studied at community level. This study aimed at investigating the sero-prevalence and associated risk factors of HBV and HCV among HBV unvaccinated community members in South Omo Zone, Southern Ethiopia.

Methods
A community-based cross-sectional study was conducted in three districts from March to May 2018. Structured questionnaire was used to collect relevant clinical and socio-demographic data. Three milliliter of blood sample was collected from each study participant and screened for HBV and HCV using one step hepatitis B surface antigen (HBsAg) test strip and one step HCV test strip, respectively. Samples found positive for HBsAg were further tested using immunoassay of Alere Determine™ HBsAg (Alere Inc., USA). Data were analyzed using SPSS version 25.0.

Results
A total of 625 (51.4% males, age 6–80 years, mean age ± SD = 30.83 ± 13.51 years) individuals participated in the study. The sero-prevalence for HBV infection was 8.0% as detected using one step HBsAg test strip, while it was 7.2% using Alere Determine™ HBsAg test. The sero-prevalence for HCV infection was 1.9%. Two (0.3%) of the participants were seropositive for both HBV and HCV infections. High sero-prevalence for HBV infection was associated with weakness and fatigue (AOR = 5.20; 95% CI: 1.58, 17.15), while high sero-prevalence of HCV infection was associated with age group between 46 and 65 years (AOR = 13.02; 95% CI: 1.11, 152.41).
Conclusion
This study revealed higher-intermediate endemicity level of HBV infection and low to inter-
mediate endemicity level of HCV infection in the study area. Clinical symptoms like weak-
ness and fatigue were found to be indictors for HBV infection, while individuals in the age
group between 46 and 65 years were at higher risk for HCV infection. Provision of commu-
nity-based health education; vaccination, mass screening and providing treatment would
have utmost importance in reducing the transmission of these diseases in the present study
area.

Introduction
Hepatitis, inflammation of the liver, can be caused by infectious and non-infectious agents
such as viruses, bacteria, fungi, parasites, alcohol, drugs, autoimmune diseases, and metabolic
diseases [1]. The most common causes of hepatitis are viruses; namely hepatitis A, B, C, D and
E viruses. Among these, hepatitis B virus (HBV) and hepatitis C virus (HCV) are the most
important causes of viral hepatitis [2].

Both HBV and HCV can be transmitted through sexual, blood or vertically from mother-
to-child [3]. Thus, individuals who need blood transfusion, those having multiple sexual part-
ners and infants born from HBV or HCV infected mothers are at a high-risk for acquiring
HBV or HCV infection [4]. Both viruses can cause acute and chronic infection of the liver [5,
6]. Chronic HBV and HCV infections are the leading causes of liver-related morbidity and
mortality [7, 8]. Between 15% and 40% of chronically infected individuals can develop serious
liver disease and transmit the viruses to others [9, 10]. Globally, around 257 million people
were living with HBV infection, and 71 million people were living with HCV infection in 2015
[4, 11]. About 1 million people die each year from cases related to viral hepatitis [4]. An esti-
mated 50% to 80% of cases of primary liver cancer result from infection with HBV [12, 13].

A safe and effective vaccine for HBV has been available since 1982, whereas no vaccine
exists for HCV [14]. Treatment options for both viruses are advancing rapidly, and several
new antiviral drugs have become available [15]. By the end of 2015, only 9% of HBV-infected
people and 20% of HCV-infected people had been diagnosed. Of those 1.7 million people who
found positive for HBV infection, only 8% were treated, while only 7% were treated among 1.1
million people who were positive for HCV infection in 2015 [4]. The global targets for 2030
are to diagnose 90% of people with HBV and HCV infections and treat 80% of eligible patients
[16].

In Ethiopia, more than 60% of chronic liver disease and up to 80% of hepatocellular carci-
noma (HCC) are due to chronic HBV and HCV infections [17]. According to WHO, Ethiopia
is among hepatitis endemic countries in the world with intermediate to hyperendemic
endemicity level [18]. However; Ethiopia is regarded as a country with no national strategy for
surveillance, prevention and control of viral hepatitis. Above all Ethiopian children including
children in our current study site have not had access to vaccination against HBV. Data on the
epidemiology of HBV and HCV infections in Ethiopia at the community level are scarce. Par-
ticularly, HCV infection remains under-diagnosed and under-reported, despite its high infec-
tious nature. Thus, lack of adequate epidemiological data at the community level on hepatitis
in Ethiopia can affect the global targets to control HBV and HCV infections. For this reason,
assessing the sero-prevalence of HBV and HCV infections at community level is very crucial
to develop strategies to reduce transmission among the community members. Therefore, this
study was aimed at investigating the sero-prevalence and associated factors for HBV and HCV infections among HBV unvaccinated community members in South Omo Zone, Southern Ethiopia.

**Materials and methods**

**Study design, period and setting**

A community-based cross-sectional study was conducted in three districts (Hamer, Debub Ari and Bena-Tsemay) of South Omo Zone, Southern Ethiopia from March to May 2018. The study area is located about 750 Kilometers from Addis Ababa, the capital city of Ethiopia. According to the 2007 Ethiopian census, the total population of South Omo Zone is 647,655 [19] and the eight largest ethnic groups are Ari (44.59%), Male (13.63%), Dasenech (8.17%), Hamer (8.01%), Bena (4.42%), Amhara (4.21%), Tsemai (3.39%), and Nyangatom (2.95%) [20]. Most of the inhabitants are nomadic pastoralists in the Hamer District and farmers in the Debub Ari and Bena-Tsemay districts [19]. The study districts were purposely selected because of their endemicity for yellow fever outbreaks [21], which has similar clinical presentations with viral hepatitis.

**Study participants, sample size estimation and sampling method**

The study participants were individual’s age between 6 and 80 years old, residents of the study districts and volunteered to participate in the study. Sample size for the nomadic population (Hamer District) was calculated with the estimated HBsAg sero-prevalence of 14.5% [22] with 95% confidence, 5% margin of error, 15% non-response rate and 1.5 design effects. For the mixed farming and settled farming population (Debub Ari and Bena-Tsemay Districts) the sample size was calculated with the assumptions: sero-prevalence of HBsAg in the community is 10.5% [23] at confidence level of 95% and 5% margin of error; estimated non-response rate 10% and design effect of 2.0. Accordingly, these resulted in minimum sample size of 621. Including few extra samples collected during the data collection, the sample size on which the current study based on is 625 (306 from Hammer District and 319 from Debub Ari and Bena Tsemay Districts). A representative sample was drawn from each study kebeles (smaller administrative units) of the study districts by distributing the overall sample size proportionally to the size of population in each study kebeles. Once after the first household was selected randomly by using lottery method, the other households from each study kebeles were selected using systematic random sampling technique after getting the $n^{th}$ value (sampling interval) by dividing the total number of households by the sample size allocated for each kebeles. From each selected households one participant was randomly recruited using lottery method.

**Data collection**

Three milliliter of a blood sample was collected from each of the study participants, and serum was separated and stored at appropriate temperature until screened for HBV and HCV infections. Structured questionnaire was administered to collect socio-demographic and relevant clinical data. One step HBsAg test strip (Nantong Diagnos Technology Co., Ltd., China) was used for the screening hepatitis B surface antigen (HBsAg). Whereas one step HCV test strip (Nantong Diagnos Technology Co., Ltd., China) was used to detect antibodies against HCV following the instructions of the manufacturer. Samples found positive for HBV infection by one step HBsAg test strip were further screened using qualitative immunoassay Alere Determinene™ HBsAg (Alere Inc., Massachusetts, USA) which is more specific but less sensitive than the One Step HBsAg test [24–26]
Data entry and analysis
Data were entered using Epi-Data Entry version 3.1 and analyzed using SPSS version 25.0. Descriptive statistics; mean, and standard deviation for continuous variables and frequency for categorical variables were used. Bivariable and multivariable logistic regression analysis were used to assess factors associated with sero-prevalence for HBV and HCV infections. Variables which showed association in multivariable analysis were considered as final predictors of the dependent variable. All tests were performed at 5% level of significance.

Ethical considerations
The study was carried out after getting ethical approval from the Institutional Review Board (IRB) of Aklilu Lemma Institute of Pathobiology, Addis Ababa University. Then, data were collected after getting permission from South Omo Zone and district health offices. The objective, the possible risks & benefits of the study were explained to the participants or their guardians in local languages and informed written consent was obtained from the participants or from their guardians. For illiterate participants who not able to read and write a fingerprint were taken instead of their signature after informing and elaborating the issues written on the consent form. The participants were assured that they had full right to participate or not to participate in the study. Sero-positive individuals were advised and linked to health facilities to obtain appropriate treatment and care. All information obtained in this study was kept confidential.

Results
Socio-demographic characteristics of the study participants
A total of 625 participants (51.4% males, age range from 6 to 80 and mean age ± SD = 30.83 ± 13.51 years) participated in this study. Table 1 shows the socio-demographic characteristics of the study participants.

Table 1. Socio-demographic characteristics of the study participants.

| Characteristics     | Category               | No. (%) |
|---------------------|------------------------|---------|
| Sex                 | Male                   | 321(51.4) |
|                     | Female                 | 304(48.6) |
| Age group           | <18                    | 64(10.2)  |
|                     | 18–29                  | 248(39.7) |
|                     | 30–45                  | 239(38.2) |
|                     | 46–65                  | 59(9.4)   |
|                     | >65                    | 15(2.4)   |
| Religion            | Orthodox               | 70(11.2)  |
|                     | Protestant             | 257(41.1) |
|                     | Traditional            | 294(47.0) |
|                     | Other                  | 4(0.6)    |
| Educational status  | Not attended formal education | 391(62.6) |
|                     | Primary school attended | 234(37.4) |
| Occupation          | Farmer                 | 259(41.4) |
|                     | Agro pastoralist       | 41(6.6)   |
|                     | Nomadic pastoralist    | 262(41.9) |
|                     | Others                 | 63(10.1)  |
| District            | Debub Ari              | 279(44.6) |
|                     | Bena-Tsemay            | 40(6.4)   |
|                     | Hamer                  | 306(49.0) |

https://doi.org/10.1371/journal.pone.0226890.t001
Clinical sign and symptoms reported by the study participants

As shown in Table 2, the most common sign and symptoms reported were upper abdominal pain especially on the right side (18.9%) followed by joint pain and muscle aches (16.0%) and weakness and fatigue (7.5%).

Sero-prevalence for HBV and HCV infections

The overall sero-prevalence for HBV infection was 8.0% (95% CI: 5.9%, 10.2%) using one step HBsAg test strip and 7.2% (95% CI: 5.2%, 9.3%) using HBsAg Alere Determine™ test. Among 50 samples found positive for HBV infection by one step HBsAg test strip, 5 samples were found negative by HBsAg Alere Determine™ test. The overall sero-prevalence for HCV infection was 1.9% (95% CI: 0.9%, 3.0%). Two (0.3%) of the participants were co-infected with both HBV and HCV. Relatively higher sero-prevalence of HBsAg (10.0%) and anti-HCV (5.0%) was observed in Bena-Tsemay district. Under the bivariable analysis, HBV infection was significantly associated with weakness and fatigue (P < 0.01) and HCV infection associated with age group (P = 0.02) (Table 3).

Independent predictors of HBV and HCV infections

A multivariable logistic regression analyses was performed to explore the independent predictors of HBV and HCV infections. Having body weakness and fatigue (AOR = 5.20; 95% CI: 1.58, 17.15) and age group 46–65 (AOR = 13.02; 95% CI: 1.11, 152.41) were significantly associated with HBV (Table 4) and HCV infections respectively at P value < 0.05 (Table 5).

Discussion

This study revealed higher-intermediate endemicity level [27, 28] of HBV infection with overall sero-prevalence of 7.2% among the general population in South Omo Zone. The sero-prevalence of HBsAg is almost similar with the previous national pooled prevalence of 7.4% of Ethiopia [23] and within the range of a prevalence of 5–10% reported among adult population in sub-Saharan African countries [29]. However the prevalence is relatively higher than 3.1%
prevalence reported from a recent community-based study done in Gojjam, Northwest Ethiopia [30]; 6.1% the whole African region and 3.5% global prevalence among the general population [4]. There is a geographical variation in the sero-prevalence of HBsAg in Ethiopia with relatively higher prevalence observed in the current study area as compared to the Gojam area study. Thus the relative increase in the prevalence of HBsAg in South Omo Zone as compared to the other geographic areas suggests the current study area is one among the priority target areas for the prevention and control of hepatitis in Ethiopia.

In the case of HCV sero-prevalence, anti-HCV detection rate varied from low to higher–intermediate endemicity levels [27, 28] among the different districts with the highest sero-prevalence (5.0%) detected in Bena-Tsemay district. The overall sero-prevalence of anti-HCV in the study area was 1.9%. The overall sero-prevalence of anti-HCV recorded in our study area was less than that from the pooled national prevalence of 3.1% [23] and 3.0% reported in Sub-Saharan Africa [31]. However, it is still greater than the 1.0% prevalence reported from Gojjam, Ethiopia [30]; 0.3% in Djibouti, 0.9% in Somalia, and 1.0% in Sudan [32] among the general populations. Although the overall sero-prevalence of HCV infection in the study area is considered to be low according to the WHO classification [27, 28], relatively higher prevalence detected in Bena-Tsemay district indicates it is a marked public health problem in that district.

Table 3. Sero-prevalence for HBV and HCV infections.

| Characteristics | Category                  | HBsAg (using Alere Determine™ test) | P value | Anti-HCV | P value |
|-----------------|---------------------------|------------------------------------|---------|----------|---------|
|                 |                           | Positive (%) | Negative (%) |         | Positive (%) | Negative (%) |
| Sex             | Male                      | 28(8.8)     | 290(91.2)    | 0.12    | 7(2.2)     | 311(97.8)     |
|                 | Female                    | 17(5.6)     | 287(94.4)    | 0.61    | 5(1.6)     | 299(98.4)     |
| Age Group       | <18                       | 2(3.1)      | 62(96.9)     | 0.64    | 1(1.6)     | 63(98.4)      |
|                 | 18–29                     | 17(6.9)     | 230(93.1)    | 0.02*   | 2(0.8)     | 245(99.2)     |
|                 | 30–45                     | 21(8.8)     | 218(91.2)    |         | 4(1.7)     | 235(98.3)     |
|                 | 46–65                     | 4(7.0)      | 53(93.0)     |         | 4(7.0)     | 53(93.0)      |
|                 | >65                       | 1(6.7)      | 14(93.3)     |         | 1(6.7)     | 14(93.3)      |
| Educational Status | Not attended formal education | 26(6.7)      | 363(93.3)    | 0.49    | 8(2.1)     | 381(97.9)     |
|                 | Primary school attended   | 19(8.2)     | 214(91.8)    |         | 4(1.7)     | 229(98.3)     |
| Occupation      | Farmer                    | 18(7.0)     | 238(93.0)    | 0.97    | 3(1.2)     | 253(98.8)     |
|                 | Pastoralist               | 22(7.3)     | 281(92.7)    |         | 7(2.3)     | 296(97.7)     |
|                 | Others                    | 5(7.9)      | 58(92.1)     |         | 2(3.2)     | 61(96.8)      |
| District        | Debub Ari                 | 19(6.9)     | 257(93.1)    | 0.78    | 2(0.7)     | 274(99.3)     |
|                 | Bena-Tsemay               | 4(10.0)     | 36(90.0)     |         | 2(5.0)     | 38(95.0)      |
|                 | Hamer                     | 22(7.2)     | 284(92.8)    |         | 8(2.6)     | 298(97.4)     |
| Upper abdominal pain | Yes                      | 12(10.2)    | 106(89.8)    | 0.17    | 4(3.4)     | 114(96.6)     |
|                 | No                        | 33(6.5)     | 471(93.5)    |         | 8(1.6)     | 496(98.4)     |
| Dark urine      | Yes                       | 6(14.0)     | 37(86.0)     | 0.08    | 1(2.3)     | 42(97.7)      |
|                 | No                        | 39(6.7)     | 540(93.3)    |         | 11(1.9)    | 568(98.1)     |
| Joint pain and Muscle aches | Yes | 9(9.0) | 91(91.0) | 0.46 | 2(2.0) | 98(98.0) |
|                 | No                        | 36(6.9)     | 486(93.1)    |         | 10(1.9)    | 512(98.1)     |
| Weakness and fatigue | Yes                      | 9(19.1)     | 38(80.9)     | <0.01*  | 0         | 47(100.0)     |
|                 | No                        | 36(6.3)     | 539(93.7)    |         | 12(2.1)    | 563(97.9)     |
| Presence of Jaundice | Yes                      | 0           | 11(100.0)    | 0.35    | 1(9.1)     | 10(90.9)      |
|                 | No                        | 45(7.4)     | 566(92.6)    |         | 11(1.8)    | 600(98.2)     |

*Significant at P value <0.05

https://doi.org/10.1371/journal.pone.0226890.t003
Since HBV and HCV share common route of transmission, co-infection between the two viruses is common, especially in high endemic areas and among people at high-risk of parenteral infection [33]. In this study co-infection between HBV and HCV infection, serologic markers was 0.3% among the general population. This is in contrast to some studies from Ethiopia where no serologic markers for HBV and HCV co-infection was reported [34–36], indicating that co-infection between HBV and HCV may not be uncommon in the areas where both HBV and HCV are endemic. Our finding is supported by many other studies conducted elsewhere which reported dual infection of HBV and HCV: 0.7% in Nigeria among prison inmates[37]; 5.9% and 2.0% in India among patients with chronic liver disease [38] and hemodialysis patients [33] respectively and 7.7% in Mongolia among patients with chronic liver disease [39]. In this study to detect the sero-prevalence of HBV infection we used the viral antigen (HBsAg) as a serologic marker while for HCV we used antibody (anti-HCV antibody). With this regard recent viral transmission may relatively contribute to high sero-prevalence of HBsAg as compared to anti-HCV which ultimately may dilute the effect in co-infection rate. Thus unlike the other studies, the observed low co-infection rate between HBV and HCV in current study area might be attributed to a more recent transmission through the sexual route in the case of HBV in addition to the expected a geographical variation.

Under the multivariate analysis, having body weakness and fatigue was independently associated with HBV serological marker (HBsAg) exposure status. Those participants having body weakness and fatigue were more likely to have HBsAg as compared to those who did not have weakness and fatigue. Table 4 shows the independent predictors of HBV infection.

### Table 4. Independent predictors of HBV infection.

| Characteristics     | Category                          | HBsAg COR (95% CI) | HBsAg AOR (95% CI) |
|---------------------|-----------------------------------|--------------------|--------------------|
| **Sex**             | Male                              | 1.63 (0.87, 3.04)  | 1.45 (0.75, 2.79)  |
|                     | Female                            | 1.00               | 1.00               |
| **Age Group**       | <18                               | 1.00               | 1.00               |
|                     | 18–29                             | 2.29 (0.52, 10.19) | 1.51 (0.31, 7.43)  |
|                     | 30–45                             | 2.99 (0.68, 13.09) | 2.10 (0.42, 10.49) |
|                     | 46–65                             | 2.34 (0.41, 13.28) | 1.92 (0.30, 12.50) |
|                     | >65                               | 2.21 (0.19, 26.17) | 1.52 (0.12, 20.07) |
| **Educational Status** | Not attended formal education | 0.81 (0.44, 1.49)  | 0.79 (0.38, 1.68)  |
|                     | Primary school attended           | 1.00               | 1.00               |
| **Occupation**      | Farmer                            | 1.00               | 1.00               |
|                     | Pastoralist                       | 1.04 (0.54, 1.98)  | 1.01 (0.31, 3.30)  |
|                     | Others                            | 1.14 (0.41, 3.20)  | 1.33 (0.3, 5.08)   |
| **District**        | Debub Ari                         | 1.00               | 1.00               |
|                     | Bena-Tsemay                       | 1.50 (0.48, 4.67)  | 1.24 (0.33, 4.76)  |
|                     | Hamer                             | 1.43 (0.47, 4.40)  | 1.87 (0.45, 7.78)  |
| **Upper abdominal pain** | Yes                           | 1.62 (0.8, 13.23)  | 1.63 (0.62, 4.27)  |
|                     | No                                | 1.00               | 1.00               |
| **Dark urine**      | Yes                               | 2.25 (0.89, 5.64)  | 1.51 (0.44, 5.20)  |
|                     | No                                | 1.00               | 1.00               |
| **Joint pain and Muscle aches** | Yes                               | 1.34 (0.62, 2.87)  | 2.03 (0.58, 7.05)  |
|                     | No                                | 1.00               | 1.00               |
| **Weakness and fatigue** | Yes                             | 3.55 (1.59, 7.900) | 5.20 (1.58, 17.15) |
|                     | No                                | 1.00               | 1.00               |

CI (confidence interval), COR (crude odds ratio), AOR (adjusted odds ratio) and * (significant at p<0.05)
weakness and fatigue were almost five times at higher risk of being positive for HBsAg as compared to their counterparts without such problem. Previously numerous studies revealed that fatigue (generalized body weakness) is the most commonly reported symptom in patients with viral hepatitis [40–43]. Worth noting here, however, since a good number of clinical symptoms of viral hepatitis overlap with those of arboviral infections [44], involvement of the later cannot be overruled. In fact, the study area is among the known hot spots for yellow fever outbreaks [21] and is also considered to be an endemic site for many arboviral diseases because of its proximity to neighboring country Kenya, where repeated arboviral disease outbreaks have been reported [45]. Moreover, multivariate analysis also indicated that those of participants in the age group 46 to 65 years were more than thirteen times at higher risk of being positive for HCV infection as compared to those in the age group less than 18 years. These implying, older individuals are at higher risk of getting HCV infection as compared to younger. The observed significantly higher sero-prevalence in older individuals might be attributed to frequency of exposure. Similar findings were reported from studies done in: Rwanda [46], Egypt [47] and Madagascar [48]. But here we couldn’t rule out a cohort effect related to historical campaigns of parenteral treatment or vaccination which probably increased the sero-prevalence of anti-HCV infection in older individuals (cohort of older participants) as observed in studies conducted in Egypt [49] and Cameroon [50].

| Characteristics          | Category                  | Anti-HCV                      |
|--------------------------|---------------------------|-------------------------------|
|                          | COR (95% CI)              | AOR (95% CI)                  |
| Sex                      | Male                      | 1.35(0.42, 4.29)              | 1.15(0.33,4.02) |
|                          | Female                    | 1.00                          | 1.00            |
| Age Group                | <18                       | 1.00                          | 1.00            |
|                          | 18–29                     | 0.51(0.05, 5.76)              | 0.59(0.05, 7.48) |
|                          | 30–45                     | 1.07(0.12, 9.76)              | 2.14(0.20, 23.28) |
|                          | 46–65                     | 4.76(0.52, 43.85)             | 13.02(1.11, 152.41) |
|                          | >65                       | 4.50(0.27, 76.38)             | 4.62(0.16, 137.01) |
| Educational Status       | Not attended formal education | 1.20(0.3, 64.04)            | 1.59(0.34,7.49) |
|                          | Primary school attended   | 1.00                          | 1.00            |
| Occupation               | Farmer                    | 1.00                          | 1.00            |
|                          | Pastoralist               | 1.99(0.51, 7.79)              | 3.81(0.24, 60.11) |
|                          | Others                    | 2.77(0.45, 16.91)             | 1.36(0.05, 36.52) |
| District                 | Debub Ari                 | 1.00                          | 1.00            |
|                          | Bena-Tsehay               | 7.21(2.00, 52.70)             | 11.20(1.07, 117.27) |
|                          | Hamer                     | 1.96(0.40, 9.57)              | 18.20(0.65, 513.25) |
| Upper abdominal pain     | Yes                       | 2.18(0.64, 7.35)              | 1.67(0.36, 7.72) |
|                          | No                        | 1.00                          | 1.00            |
| Dark urine               | Yes                       | 1.23(0.16, 9.75)              | 1.47(0.13,16.22) |
|                          | No                        | 1.00                          | 1.00            |
| Joint pain and Muscle aches | Yes                  | 1.05(0.23, 4.84)              | 2.26(0.37,13.69) |
|                          | No                        | 1.00                          | 1.00            |
| Presence of Jaundice     | Yes                       | 5.46(0.64,46.38)              | 3.50(0.24, 52.29) |
|                          | No                        | 1.00                          | 1.00            |

CI (confidence interval), COR (crude odds ratio), AOR (adjusted odds ratio) and * (significant at p<0.05)

https://doi.org/10.1371/journal.pone.0226890.t005
Limitations of the study
The findings of this study should be interpreted in the light of the following potential limitations. Firstly, our serologic assays for HBV and HCV detection did not provide evidence of active viremia and identification of infected individuals in the antibody-negative phase (those in the window period) for HCV detection. On the top, due to constraint of resource, we didn’t conduct confirmatory test using specific assays for samples being positive for HCV, that probably may overestimated the sero-prevalence pertaining to HCV.

Conclusion
In general, the finding in this study revealed a higher-intermediate HBV and a low to intermediate HCV infection endemicity levels among the general population in South Omo Zone. Those individuals having body weakness and fatigue and older individuals (age group 46–65) were at higher risk of acquiring HBV and HCV infections, respectively. These observations call for responsible health policy makers to develop a practical plan of intervention with the goal of prevention and control of these infections, such as screening those belonging to the high-risk group among the general population, improvement in the expansion of HBV vaccination and provision of health education. Further research using molecular and other more sensitive and specific assays for detecting active HBV and HCV infections is also needed for the future.

Supporting information
S1 Dataset.
(SAV)

Acknowledgments
The authors would like to acknowledge the study participants and South Omo Region and Districts Health Administration.

Author Contributions
Conceptualization: Adugna Endale Woldegiorgis, Woldearegay Erku, Girmay Medhin, Nega Berhe, Mengistu Legesse.
Data curation: Adugna Endale Woldegiorgis, Woldearegay Erku, Girmay Medhin, Nega Berhe, Mengistu Legesse.
Formal analysis: Adugna Endale Woldegiorgis, Girmay Medhin, Mengistu Legesse.
Funding acquisition: Mengistu Legesse.
Investigation: Adugna Endale Woldegiorgis, Woldearegay Erku, Girmay Medhin, Nega Berhe, Mengistu Legesse.
Methodology: Adugna Endale Woldegiorgis, Woldearegay Erku, Girmay Medhin, Nega Berhe, Mengistu Legesse.
Software: Adugna Endale Woldegiorgis, Girmay Medhin.
Supervision: Adugna Endale Woldegiorgis, Woldearegay Erku, Girmay Medhin, Nega Berhe, Mengistu Legesse.
Validation: Adugna Endale Woldegiorgis, Woldearegay Erku, Girmay Medhin, Nega Berhe, Mengistu Legesse.

Visualization: Adugna Endale Woldegiorgis, Woldearegay Erku, Girmay Medhin, Nega Berhe, Mengistu Legesse.

Writing – original draft: Adugna Endale Woldegiorgis.

Writing – review & editing: Adugna Endale Woldegiorgis, Woldearegay Erku, Girmay Medhin, Nega Berhe, Mengistu Legesse.

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