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Journal of Human Virology & Retrovirology

Research Article

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Human hepatitis e virus among apparently healthy individuals in Ogbomoso, South-Western Nigeria

Abstract

This study was undertaken to determine the seroprevalence, and associated risk factors, of hepatitis E virus. A total of 186 consented apparently healthy individuals were recruited. Interviewer-administered questionnaire was used to obtain the socio-demographic information from the individuals. Blood samples were collected and analyzed for anti-HEV using third generation enzyme-linked immunosorbent assay (ELISA). Samples were collected over a period of 10 months (December 2014 – September 2015). Results obtained were analyzed using Statistical Package for Social Sciences (SPSS) version 20.0 statistical software; Chi-square ($\chi 2$) test was utilized to assess the association between the socio-demographic variables and HEV status while Logistic regression was done to determine the strength of association between the potential risk factors and HEV status (statistical significance was set at $P < 0.05$). The overall anti-HEV prevalence was 2.7% (5/186). The highest seroprevalence was in the age range 15-25 (4.1%) years. Males had higher prevalence (3.2%). None of the sociodemographic status and potential risk factors were significantly associated with HEV infection ($P > 0.05$). Preventive public health measures should be maintained among individuals and communities. Data suggest further research with larger population as HEV remains an under-recognized public health challenge.

Keywords: Anti-HEV, ELISA, Prevalence, Potential risk factors, Ogbomoso

Volume 5 Issue 1 - 2017

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Received: December 27, 2016 | **Published:** January 19, 2017

Background

Hepatitis E virus (HEV) is a small non-enveloped positive sense single stranded RNA icosahedral virus with a 7.7 kilobase genome that belongs to the genus *Herpevirus*.[1] Hepatitis E virus infections occur world-wide. The virus is endemic in regions of the world characterized with poor sanitation (such as Africa, Asia and Central America) as epidemiologic studies have shown the route of transmission to be by faecal-oral route with contaminated food and water being the primary source of infection.[2,3] However, blood borne transmission of HEV has been investigated as one of the possible risk factors for acquiring hepatitis E virus.[1] This transmission can be from any apparently healthy individual who can be potential blood donor to healthy/unhealthy individuals during blood transfusion. Other possible risk factors are not limited to previous history of surgery or alcohol intake.[4] Even though hepatitis E infections are self-limiting among immunocompetent individuals, persistency can result into fulminant hepatitis.[3,5]

Since the discovery of HEV, several outbreaks of the infection have been reported among pregnant women,[6] HIV positive individuals,[1] sick individuals,[3] animal handlers[7] as well as apparently healthy individuals.[8] Thus, apparently healthy individuals are considered a high risk group for HEV infection in endemic areas; however, this assumption is based on outbreak reports only, as no studies have been performed comparing exposure to HEV among this group.

World-wide, HEV infections are recognized serious threat to public health particularly in developing countries, where the virus is endemic.[9] In Nigeria, seroprevalences differ considerably, ranging from 5.5% in Ogbomoso,[1] 13.4% in Ekiti,[3] 17.8% in Lagos[7] to 42.7% in Plateau,[6] but little is known on potential risk factors involved in acquiring the virus. Thus, the present study aimed at investigating the seroprevalence of antibodies against HEV and studying potential risk factors, other than through faecal-oral transmission, associated with blood borne transmission in different areas of Ogbomoso.

Materials and methods

Study area

The study was carried out at Ogbomoso, Oyo State in the tropical belt of Southern Western part of Nigeria (Africa). Its coordinates are 8º7′60″N and 4º16′0″E in DMS (Degrees Minutes Seconds) or 8.13333 and 4.26667 (in decimal degrees).

Study population

Consenting apparently healthy individuals residing in different areas of Ogbomoso in the age range 16 to 65 years were enrolled for this study between December 2014 and September 2015. Structured questionnaires about socio-demographic characteristics and other relevant information were administered to all participating subjects as well as verbal and informed consent form prior blood sample collection. The study protocol was in accordance with the amended Declaration of Helsinki. Any individual who refused to give consent as well as provide necessary information on the questionnaire was excluded from the study.

Blood sample collection

Five ml of venous blood samples was collected in tubes with no anticoagulant. Blood sample was spun with a bench centrifuge at 3000rpm for 10 minutes to obtain serum. Serum was obtained and stored at -20 °C until ready for analysis.

Antibody detection

Commercially available third generation ELISA kits (WKEA MED SURPLUS CORP, China) were employed to determine specific antibodies against hepatitis E virus (HEV) according to the manufacturer's instructions. The optical density was read using the Emax endpoint ELISA microplate reader (Molecular Devices, California, and USA) and the result was interpreted according to the manufacturer's instruction.

Statistical Analysis

The prevalence of antibodies to HEV was determined from the proportion of the positive individuals in the total population studied and expressed as percentages. The data obtained was analyzed using a Statistical Package for Social Sciences (SPSS version 20). They were organized and summarized in terms of frequencies and the results of the study were presented in tables and figures. Chi-square ($\chi 2$) test was utilized to assess the association between the socio-demographic variables and HEV status. Statistical significance was set at $P < 0.05$. Pie and bar charts were used for presenting the analyzed data. Logistic regression was done to determine the strength of association between the potential risk factors and HEV status.

Results

Demographic characteristics of the study population

The study included 186 participants, consisting of 93 males and 93 females respectively, in the age range 16-65 years with a mean age of 31.62±7.85 years. The sociodemographic characteristics of the participants is shown in Table 1. The highest participants were in the age range 26-35 years (51.1%) while the lowest was in the age range 56-65 years (0.5%).

Out of the 186 study participants, 5 (2.7%) sera were positive for anti-HEV as shown in Table 2.

Table 1 Socio-demographic factors of the study participants

Parameter	Level	Frequency	Percentage
Age	15-25	49	26.3
	26-35	95	51.1
	36-45	32	17.2
	46-55	9	4.3
	56-65	1	0.5
Sex	Male	93	50
	Female	93	50
Marital Status	Monogamy	132	71.0
	Polygamy	9	4.8
	Single	45	24.2
Occupation	Artisan	34	18.3
	Civil servant	54	29.0
	Student	42	22.6
	Trader	47	25.3
	Others	1	0.5
	None	8	4.3
Education	Primary	17	9.1
	Secondary	44	23.7
	Tertiary	106	57.0
	Others	17	9.1
	None	2	1.1

Table 2 Seroprevalence of HEV infections among the study participants

Status	Total (%)
Reactive	5 (2.69)
Non-Reactive	181 (97.31)
Total	186 (100.00)

Prevalence of anti-HEV status in relation to sociodemographic characteristics

The distribution of seropositive samples according to gender, occupation, education and marital status of the study participants are shown in Table 3. Seroprevalence in male and female was 3.2% (3/93) and 2.2% (2/93) respectively. However, there was no statistical significant difference ($p>0.05$) in anti-HEV positivity and sex distribution.

Table 3 Seroprevalence of HEV infection in relation to sociodemographic characteristics

HEV Status						
Parameter	**Level**	**Positive (%)**	**Negative (%)**	**Df**	**Chi-square**	***P*-value**
Age	15-25	2 (4.1%)	47 (95.9%)	4	1.604	0.808
	26-35	3 (3.2%)	92 (96.8%)			
	36-45	0 (0.0%)	32 (100.0%)			
	46-55	0 (0.0%)	9 (100.0%)			
	56-65	0 (0.0%)	1 (100.0%)			
Sex	Male	3 (3.2%)	90 (96.8%)	1	0.206	0.650
	Female	2 (2.2%)	91 (97.9%)			
Marital status	Monogamy	3 (2.3%)	129 (97.7%)	2	0.886	0.648
	Polygamy	0 (0.0%)	9 (100.0%)			
	Single	2 (4.4%)	43 (95.6%)			
Occupation	Artisan	1 (2.9%)	33 (97.1%)	5	2.880	0.718
	Civil servant	0 (0.0%)	54 (100.0%)			
	Student	2 (4.8%)	40 (95.2%)			
	Traders	2 (4.3%)	45 (4.3%)			
	Others	0 (0.0%)	1 (100.0%)			
	None	0 (0.0%)	8 (100.0%)			
Education	Primary	1 (5.9%)	16 (94.1%)	4	1.873	0.759
	Secondary	0 (0.0%)	44 (100.0%)			
	Tertiary	3 (2.8%)	103 (97.2%)			
	Others	1 (5.9%)	16 (94.1%)			
	None	0 (0.0%)	2 (100.0%)			

Age-specific prevalence of anti-HEV decreased with age, with 4.1% (2/49) among the subjects in the age range 16-25 years, 3.2% (3/95) in the age group 26-35 years and 0.0% (0/42) over 35 years. There was no significant difference ($p > 0.05$) between seropositivity and age distribution.

Occupation wise, 4.8% (2/42) was recorded among students, 4.3% (2/47) among traders, 2.9% (1/34) among artisans. There was no record of prevalence among those who had other occupation or those that had no occupation. Also, there was no statistical significant difference ($p > 0.05$) between seropositivity and occupation.

Considering educational status, the highest prevalence 5.9% (1/17) was recorded among those that had primary and other education respectively followed by 2.8% (3/106) among those that had tertiary education. There was no statistical significance between seropositivity and education.

Considering marital status, participants who were single had a higher prevalence of 4.4% (2/45) than 2.3% (3/132) prevalence in the monogamy group. However, there was no statistical significant effect of marital status on HEV seroprevalence.

Association between potential risk factors and HEV status

Associations between potential risk factor and HEV status is presented in Table 4. From the analysis, there was no statistical association ($P>0.05$) between HEV and the potential risk factor considered. The result showed that there was a prevalence of 2.7% among the study participants with no record of previous history of blood transfusion as compared with those that with previous history of blood transfusion. However, there was no statistical significance ($\chi 2=0.201$, df=1, $P=0.654$). There is a 1-fold risk of getting infected among those who had previous history of blood transfusion (95% CI = 0.934-0.990, OR = 1.0).

Citation: Oladipo EK, Awoyelu EH, Oloke JK. Human hepatitis e virus among apparently healthy individuals in Ogbomoso, South-Western Nigeria. *J Hum Virol Retrovirol.* 2017;5(1):1–6. DOI: 10.15406/jhvrv.2017.05.00137

Table 4 Association of potential risk factor and HEV

Variables	Status		OR	95% CI	*P*-value
	Positive N (%)	Negative N (%)			
History of Blood Transfusion					
No	5(4.5)	174(95.5)	0.961	0.934-0.990	0.654
Yes	0(0.0)	7(100.0)	1		

Discussion

The overall seroprevalence of anti-HEV recorded was 2.7%. The prevalence is the same with the prevalence recorded in United States.[10] However, it is lower than a prevalence of 22.5% in Rural Bangladesh,[8] 14.3% in Austria,[2] 5.38% in Italy,[4] 5.8% in Ghana[11] 18.8% among schistosomiasis patients in Northeastern Brazil.[12] It is higher than a 2.6% prevalence recorded at Switzerland.[13]

In Iran, the prevalence recorded in this study falls within the prevalence of 1.1% - 14.2% and 1.6% - 11.3% recorded among the general population and patients infected with other hepatitis viruses respectively, but it is lower than 4.5% - 14.3%, 6.1% - 22.8%, 6.3% - 28.3%, 27.5%, 30.8% and 10% - 16.4% recorded among blood donors, injecting drug users, hemodialysis patients, patients with chronic liver disease, kidney transplant recipient patients and human immunodeficiency virus-infected patients respectively.[14] This difference may be ascribed to difference in geographical location,

From previous studies in Nigeria, the prevalence observed in this study is lower than a 5.5% prevalence recorded in Ogbomoso[1] among individuals infected with HIV, 8.3% prevalence observed in Ekiti,[3] 31.1% in Plateau,[6] 7.7% in Cross river.[15] The difference in the prevalence may be ascribed to differences in the sensitivity and specificity of the assay used in various studies, difference in study groups, socio-economic, cultural, hygienic and climatic conditions.

The individuals' ages varied from 15 to 65 years. This study showed a decreasing seroprevalence, from 4.1% in the age range 15-25 years to 3.2% in the age range 26-35 years. This age-specific prevalence might be due to increased exposure to high-risk environments through consumption of contaminated food and water among the age group 15-25 years as compared to the age group 26-35 years. This is in agreement with the reports of Ekanem et al.[15] and Martinson et al.[16] that recorded a high prevalence among the age group 16-18 years that fall within the recorded age group. However, there was no significant association of age to anti-HEV positivity.

In the present study, there was no significant association between sex and anti-HEV positivity. Males, however, had a higher prevalence rate of 3.2% as compared with the females who had a prevalence rate of 2.2%. The finding might be attributed to increased exposure of males to contaminated water, contaminated food sources and respective sanitary conditions as compared to females.[2] This disagrees with the reports of Junaid et al.,[6] Ekanem et al.[15] and Ofosu-Appiah et al.[11] where higher prevalence was recorded among females as compared with males.

Considering marital status, a higher prevalence (4.4%) was recorded among the singles as compared to the married (2.3%). This disagrees with the reports of Labrique et al.[8] and Junaid et al.[6] where a higher prevalence was documented among married people than singles. This might be attributed to increased sexual activity among singles as compared to married in the study area, which can lead to sexual transmission. There was no statistical significant association between marital status and anti-HEV positivity.

Considering occupation, there was a record of higher prevalence among the students (4.8%) as compared to traders (4.3%) and artisans (2.9%) respectively. This might be attributed to low personal hygiene and overcrowding where students reside. This suggests that person-to-person contact is probably a major transmission factor among students. Overcrowded areas carry the risk of poor sanitation conditions and low standard of lifestyle.

From the study, previous history of blood transfusion was not statistically significant to acquisition of HEV. This disagrees with the report of Junaid et al.[6] who recorded a strong association of HEV IgM with history of blood transfusion, but not with IgG. Although, there is no strong evidence that HEV is being transmitted through blood transfusion or blood products.[17]

Considering educational background, individuals who had primary education and other form of education had higher prevalence rate (5.9%) as compared to those that had tertiary education (2.8%). This is consistent with the findings of Junaid et al.[6] that low educational attainment is related to low socioeconomic status which in turn results in lack of knowledge about the possible risk factors associated with HEV infection.

In conclusion, this study suggests that a significant number of people in the study area had been exposed to HEV. Findings from the study suggests that socioeconomic status and education are the biggest factor behind higher prevalence rates of HEV. Preventive public health measures should be maintained among individuals and communities. Proper blood screening should be imbibed and maintained by blood banks.

Acknowledgements

We are thankful to all the study participants and staff in the microbiology research laboratory of Prof. J.K. Oloke at Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria who contributed immensely to the study.

Conflicts of interest

None.

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