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Original Research Article

Serological Profile and Epidemiological Characteristics of Hepatitis A and Hepatitis E Viruses: A Laboratory-Based Cross-Sectional Study from a Medical College in Kolkata

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Conflict of interest: Nil

Abstract

Background: Hepatitis A virus (HAV) and Hepatitis E virus (HEV) are major causes of enterically transmitted viral hepatitis in India, with variable regional distribution. Updated serological data from eastern India remain limited.

Methods: A laboratory-based cross-sectional study was conducted from January to December 2025 at a medical college in Kolkata. A total of 417 serum samples received for anti-HAV IgM and anti-HEV IgM testing were analyzed using ELISA. Demographic and seasonal data were evaluated using descriptive statistics.

Results: Of 417 samples, 51 (12.2%) were seropositive for HAV and 15 (3.6%) for HEV. HAV–HEV coinfection was detected in 5 cases (1.19%). HAV seropositivity was highest in the 11–15-year age group, whereas HEV was more common in young adults (21–25 years). Male predominance was observed for both HAV (66.7%) and HEV (60%). Seasonal clustering of HAV cases was noted during late winter to early monsoon months, while HEV cases were sporadic.

Conclusion: HAV remains the predominant enterically transmitted hepatitis virus in this region, with distinct age and seasonal patterns. Continued surveillance and targeted preventive strategies are warranted to reduce disease burden.

Keywords: Hepatitis A; Hepatitis E; Seropositivity; Cross-sectional study; Seasonal distribution.

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Introduction

Viral hepatitis is a worldwide public health problem, especially in low socioeconomic countries. Acute viral hepatitis caused by Hepatitis A and Hepatitis E continue to cause substantial morbidity and mortality as the WHO estimates in 2016, 7134 persons died from hepatitis A worldwide (accounting for 0.5% of the mortality due to viral hepatitis) [1]. HEV caused 3450 deaths and there were an estimated 19.47 million cases of acute hepatitis E (AHE) globally in 2021; HEV was responsible for 5.4% of global disability-adjusted life years (DALYs) related to acute hepatitis [2].

HAV is responsible for tens of millions of infections annually, while HEV causes nearly 20 million infections worldwide, with tens of thousands of deaths reported in some studies. The number of hepatitis A cases in 2023 was 1.2 times as high as in 2015.with people of 30–39 years age group reporting the highest rate of hepatitis A [3]. HAV and HEV are important causes of acute viral hepatitis and acute liver failure in India. Hepatitis A virus (HAV) and hepatitis E virus (HEV), both enterically transmitted, are highly endemic in India. HEV has been responsible for several epidemics. HAV is responsible for 10-30% of acute hepatitis and 5-15% of acute liver failure cases in India. HEV is responsible for 10-40% of acute hepatitis and 15-45% of acute liver failure in India. Acute HEV leads to acute liver failure more frequently during pregnancy, resulting in high mortality rate of 15 to 25% in women, predominantly in the third trimester. HEV co infection is responsible for 10-15% of cases of acute on chronic liver failure in India. [4]

Transmission is mainly through contaminated water and food; HEV also demonstrates zoonotic and transfusion-related transmission in certain regions. Although most infections are self-limiting,

HEV is associated with acute liver failure, extra-hepatic manifestations, chronic infection in immunocompromised individuals, and high maternal mortality, underscoring its public health importance. Recent studies show lack of childhood exposure to HAV in high socio-economic conditions contributes to a large non-immune population. This resulted growing proportion of unexposed individuals to HAV infection in childhood, therefore an increase in susceptible adolescent and adult populations in the affluent urbanized pockets. [1] HEV continues to affect mainly adults and is associated with severe outcomes, including fulminant hepatitis, especially in pregnant women.

Seroprevalence data reveal variable exposure. Several outbreaks in India are reported by Integrated Disease Surveillance Programme (IDSP) to National Centre for Disease Control (NCDC). Several studies over the last century report a shift of endemicity from high to intermediate endemicity in India.

Novelty of the Study/ Rationale: There are limited research data on recent sero prevalence of Hepatitis A and E in eastern India. The present study will uniquely provide a comprehensive analysis of sero prevalence of enteric hepatitis over this geographical region. By integrating epidemiological data, the research highlights the prevalence and distribution of HAV and HEV in different demographic groups. The study analyses the demographic distribution and prevalence pattern, thus will contribute by offering epidemiological insights and public health strategies in managing acute outbreaks and eliminate endemicity of enteric hepatitis. This dual approach enhances the clinical and public health relevance of the findings, distinguishing this study from prior research.

Research Question

Primary Research Question: What is the sero-prevalence of Hepatitis A and E among patients presenting with acute hepatitis in a tertiary care centre. What is the prevalence of Hepatitis A and E coinfection in the tertiary healthcare centre.

Secondary Research Questions: What is the association of Hepatitis A and E infections with seasonal variations and demographic factors (age and gender). If any association is present, is it comparable to the scenario of other parts of the country?

Objective(s) of the study:

1. To estimate the proportion of HAV and HEV amongst amongst the study population.
2. To assess the proportion of HAV and HEV co-infection amongst the study population
3. To evaluate the association of demographic factors and seasonal distribution during the study period.

Methodology

Study Design: This is cross-sectional laboratory-based study to detect IgM anti-HAV antibodies and IgM anti-HEV antibodies in samples of patients suspected of acute viral hepatitis.

Study Duration: The study started from January to December 2025. Patient demographics such as age and gender were recorded. Analysis of the tests done from the data obtained during diagnosis.

Study Unit: The study included all 417 samples, received for testing of Hepatitis A and Hepatitis E Ig M in the Department of Microbiology, College of Medicine and Sagore Dutta Hospital over the study period.

Diagnostic Kits: We used Qualisa ELISA kits (Tulip Diagnostics) to detect IgM anti-HAV and IgM anti-HEV antibodies, kit is approved by the government for testing serum samples from patients.

Statistical Analysis

Descriptive Statistics: Data were entered and analyzed using standard statistical software (SPSS/R). Demographic variables including age and gender were summarized using descriptive statistics. Seroproportion of Hepatitis A virus (HAV) Ig M and Hepatitis E virus (HEV) IgM was expressed as proportions with 95% confidence intervals. Age was analyzed both as a continuous variable and in predefined age groups to assess age-related shifts in seropositivity. Seasonal trends were analyzed by categorizing months of sample collection into pre-monsoon, monsoon, and post-monsoon periods and seasonal proportion was described using graphical methods.

Data Analysis Tools: Data analysis was performed using statistical software such as SPSS (latest version). Graphs and tables were created using Microsoft Excel (Office 365).

Results

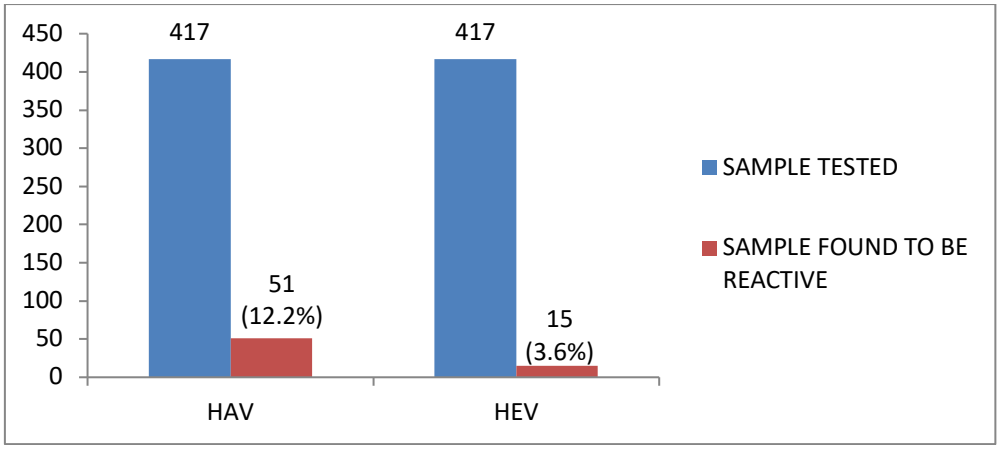

Figure 1: Distribution of HAV and HEV seroreactive cases among 417 study samples.

The age-wise distribution shows that HAV seroreactivity is markedly higher than HEV across all age groups.

- The highest number of HAV cases was observed in the 11–15 years age group (15 cases), followed by 5–10 years (13 cases) and 16–20 years (9 cases), indicating that HAV predominantly affects children and adolescents.
- HEV cases were comparatively fewer, with a peak in the 21–25 years age group (5 cases).
- In younger children (<5 years), both HAV (3 cases) and HEV (1 case) were present but at lower frequencies.
- A declining trend of both HAV and HEV seroreactivity is observed after 25 years of age.

Overall, the data suggest that HAV infection is more common in school-aged children and adolescents, while HEV shows relatively higher occurrence in young adults, reflecting differences in epidemiological patterns and transmission dynamics between the two viruses.

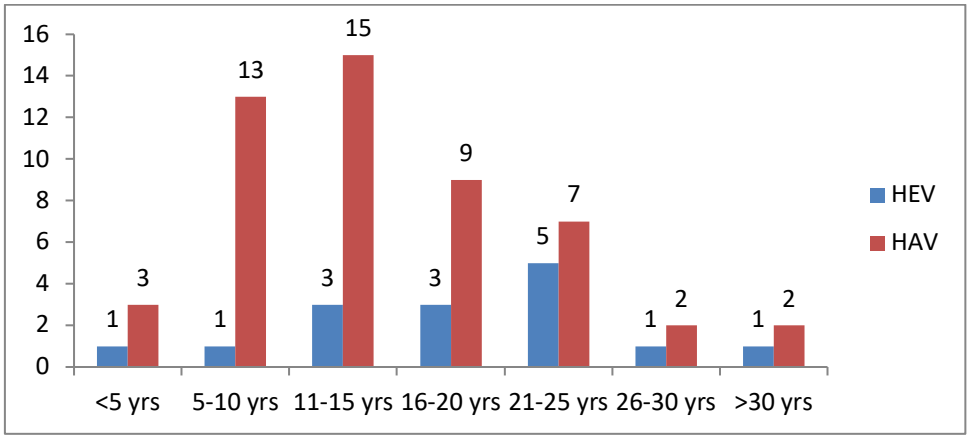

Figure 2: Age-wise distribution of Hepatitis A virus (HAV) and Hepatitis E virus (HEV) seroreactive cases among study participants.

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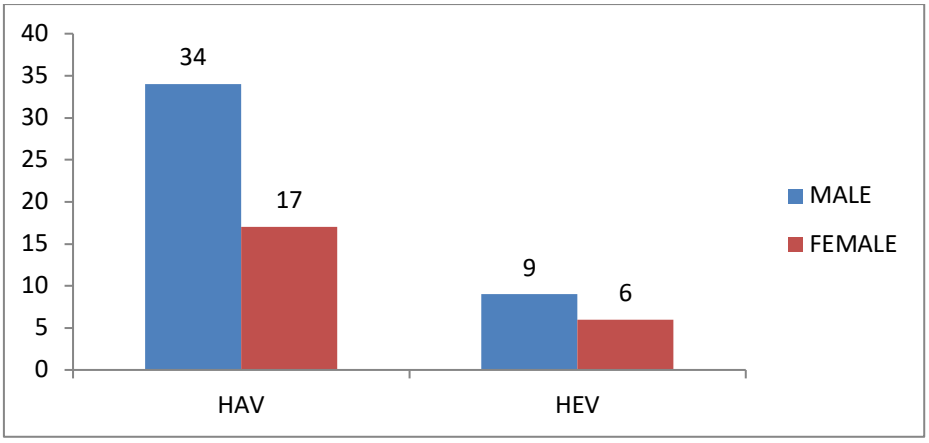

Figure 3: Gender-wise distribution of HAV and HEV seroreactive cases among the study population.

The gender-wise analysis shows a male predominance in both HAV and HEV seroreactive cases.

- Among HAV-positive cases (n = 51), 34 (66.7%) were males and 17 (33.3%) were females.
- Among HEV-positive cases (n = 15), 9 (60%) were males and 6 (40%) were females.

These findings indicate that seroreactivity for both HAV and HEV is higher in males compared to females in the study population. The difference is more pronounced in HAV infection. The observed male predominance may be attributed to greater environmental exposure, occupational factors, or behavioral differences, although further statistical analysis would be required to determine whether this difference is statistically significant.

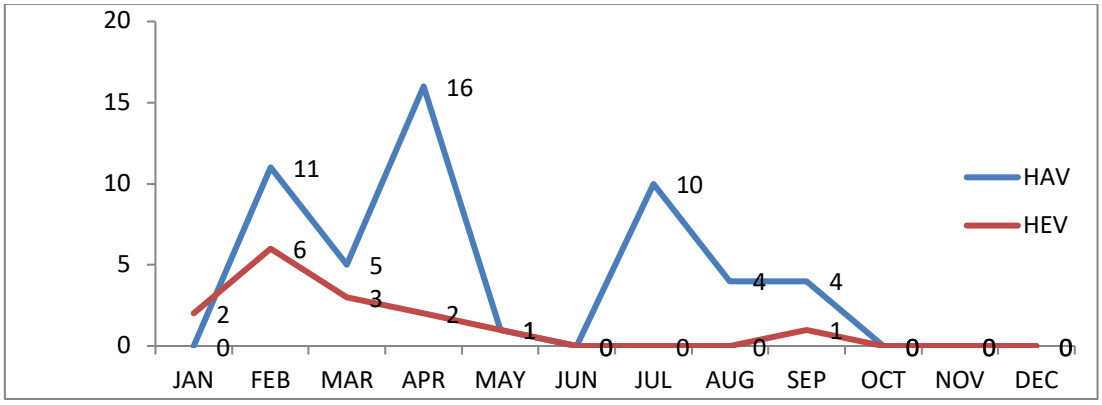

Figure 4: Monthly (seasonal) distribution of HAV and HEV seroreactive cases among the study population.

The seasonal trend demonstrates a clear variation in HAV cases across different months, whereas HEV cases remain comparatively low throughout the year.

- HAV cases peaked in April (16 cases), followed by February (11 cases) and July (10 cases).
- Moderate numbers were observed in March (5 cases) and August–September (4 cases each).
- No HAV cases were reported in June, October, November, and December.

In contrast:

- HEV cases were fewer and showed a small peak in February (6 cases).
- Sporadic cases were noted in January (2 cases), March (3 cases), April (2 cases), May (1 case), and September (1 case).
- No HEV cases were observed from June onwards except September.

Overall, HAV shows a distinct seasonal clustering, particularly during late winter to early monsoon months, suggesting possible association with water contamination or environmental factors. HEV displays a less pronounced seasonal trend, with sporadic distribution across the early months of the year.

These findings highlight the potential influence of seasonal and environmental conditions on enterically transmitted viral hepatitis.

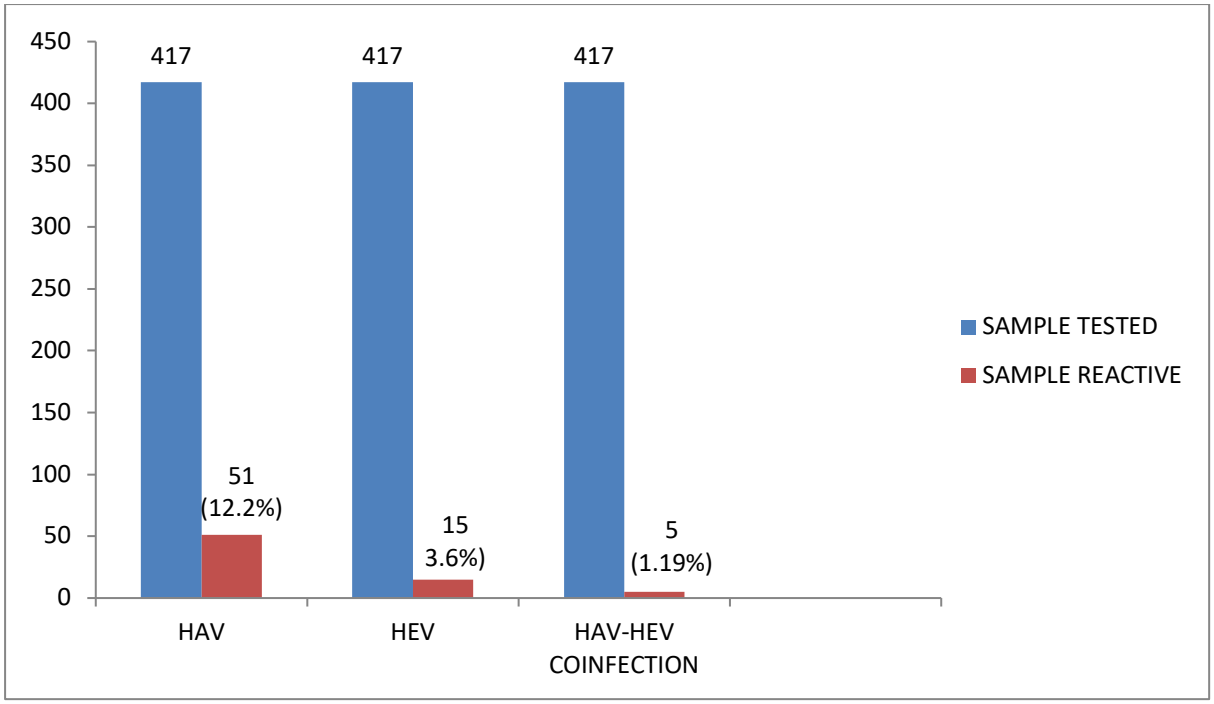

Figure 5: Seroprevalence of HAV, HEV, and HAV–HEV coinfection among 417 study samples.

Out of the total 417 samples tested**,**

- 51 cases (12.2%) were seroreactive for HAV**.**
- 15 cases (3.6%) were seroreactive for HEV**.**
- 5 cases (1.19%) showed HAV–HEV coinfection**.**

The findings demonstrate that HAV infection is the most prevalent among the study population, followed by HEV. Coinfection with both HAV and HEV was relatively uncommon but clinically significant.

The higher seroprevalence of HAV compared to HEV suggests greater exposure or endemicity of HAV in the study area. Although coinfection was observed in a small proportion of cases, its presence highlights the possibility of simultaneous exposure to both enterically transmitted hepatitis viruses, which may have implications for disease severity and patient management.

Overall, the data indicate that HAV remains the predominant cause of acute viral hepatitis in the studied cohort, with HEV contributing to a smaller but notable proportion of cases.

Discussion

The present study evaluated the seroprevalence and epidemiological distribution of HAV and HEV among 417 suspected cases of acute viral hepatitis (AVH). The overall seroprevalence of HAV (12.2%) was significantly higher than HEV (3.6%), with HAV–HEV coinfection observed in 1.19% of cases. These findings indicate that HAV remains the predominant enterically transmitted hepatitis virus in the studied population. Marked inter-state variation in HAV and HEV epidemiology has been documented across India. High HAV endemicity (>90%) has been reported from Uttar Pradesh, whereas Kerala demonstrates lower endemicity, reflecting improved sanitation and socioeconomic development (5). The present study appears to reflect an intermediate endemicity pattern, with moderate HAV prevalence (12.2%) and lower HEV prevalence (3.6%).

A tertiary care study from Central India reported HEV (13.7%) as the most common etiological agent of AVH, followed by HAV (5.1%) (6). In contrast, our findings show HAV predominance over HEV, suggesting possible regional variation in transmission dynamics.

Similarly, a two-year cross-sectional study from Mangalore documented higher seroprevalence rates for both HAV (19.31%) and HEV (10.54%) compared to the present study (7). The relatively lower prevalence observed in our cohort may reflect differences in population characteristics, outbreak status, or improvements in sanitation.

In a retrospective study of 675 AVH cases, the prevalence of HAV, HEV, and coinfection was 6.96%, 9.63%, and 2.07%, respectively (8). Compared to this, our study demonstrates higher HAV but lower HEV prevalence, while the coinfection rate (1.19%) remains within the lower reported range.

A three-year observational study from Western India reported HAV positivity in 6.7% and HEV in 8.5% of cases, with coinfection in 0.60% (9). Again, HEV predominated in that region,

contrasting with the HAV predominance seen in the present study.

In Northern India, HEV seroprevalence (28.04%) was markedly higher than HAV (14.7%), with dual infection reported in 5.9% [10]. Similarly, an Eastern Indian study documented HAV at 11.2% and HEV at 20.05% [11]. These findings differ substantially from our data, where HEV prevalence was comparatively low.

Interestingly, a South Indian study by Parameswari et al. reported a very high HAV prevalence (42.9%) with low HEV prevalence (2.49%) and coinfection of 1.24% [12]. This pattern closely resembles the present study in terms of HAV predominance and comparable coinfection rates.

Thus, the comparative analysis highlights significant geographical heterogeneity in HAV and HEV epidemiology across India. While several regions report HEV predominance, the present study demonstrates a clear predominance of HAV.

Regarding age wise distribution, the present study show HAV predominantly affected children and adolescents, particularly the 11–15 years age group, whereas HEV showed relatively higher occurrence in young adults (21–25 years). This aligns with the known epidemiological pattern wherein HAV is more common in younger populations in regions transitioning from high to intermediate endemicity. Studies from Northern and Western India have similarly documented HAV predominance in pediatric and adolescent age groups, while HEV is more frequent in adults [9,10].

The declining trend after 25 years of age in our study may reflect prior immunity due to earlier exposure.

Gender wise, a male predominance was observed in both HAV (66.7%) and HEV (60%) infections. Similar male preponderance has been reported in multiple Indian studies [6,9], likely attributable to greater environmental exposure, occupational activities, and healthcare-seeking behavior differences. However, statistical testing would be required to confirm significance.

The present study demonstrated a seasonal clustering of HAV cases, with peaks during late winter to early monsoon (February–April) and another rise in July. HEV showed a smaller peak in February with sporadic cases thereafter.

Seasonal trends of enteric hepatitis viruses are well documented across India. Both HAV and HEV infections commonly peak during pre-monsoon and monsoon months due to contamination of water sources during flooding and sewage overflow [5]. Our findings are consistent with this pattern, supporting the role of environmental and waterborne transmission. HAV–HEV coinfection was observed in 1.19% of cases in the present study. Reported coinfection rates vary widely across India, ranging from 0.60% [9] to 5.9% [10]. Although relatively uncommon, coinfection is clinically important due to the potential for more severe hepatic dysfunction. The observed rate in our study falls within the lower reported spectrum.

The predominance of HAV in the present study suggests ongoing fecal–oral transmission, possibly reflecting gaps in sanitation and safe water supply. While HAV vaccination is not included in India's national immunization program, increasing susceptibility in older children and adolescents supports consideration of targeted vaccination strategies.

HEV, although less prevalent in our cohort, remains clinically significant, especially in pregnant women where severe outcomes have been documented [8]. Incorporating HEV screening into antenatal care in endemic regions may be beneficial.

Improvement in water quality, sanitation infrastructure, outbreak surveillance, and public awareness regarding hygiene remain critical preventive strategies.

Overall Conclusion of Comparative Analysis

The present study demonstrates:

- HAV predominance (12.2%)
- Lower HEV prevalence (3.6%)
- Low but noticeable coinfection rate (1.19%)
- Predominant involvement of adolescents
- Male preponderance
- Seasonal clustering during pre-monsoon months

When compared with studies across India, our findings align with regions demonstrating intermediate endemicity and HAV predominance, while differing from areas where HEV is the leading cause of AVH. These variations likely reflect regional differences in sanitation, water quality, socioeconomic conditions, and outbreak patterns.

Ethical Considerations: There was no conflict of interest and breech of ethical pillars.

Relevance of the study : This study is highly relevant to clinical and public health practices, focusing on seroprevalence of Hepatitis A and E. Furthermore, the study's epidemiological data on distribution of exposure of enteric hepatitis can direct public health strategies, including vaccination campaigns and outbreak preparedness.

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