

Seroprevalence of Hepatitis A Virus (HAV) Antibodies Among Patients Attending University of Maiduguri Teaching Hospital, Northeast Nigeria

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ABSTRACT

Hepatitis A virus (HAV) remains an important cause of acute viral hepatitis in regions with inadequate sanitation and unsafe water sources. Understanding the seroprevalence and determinants of HAV infection is essential in highly endemic settings such as Maiduguri, Borno State, Nigeria. A cross-sectional study involving 200 participants was conducted to assess HAV-specific immunoglobulin G (IgG) and immunoglobulin M (IgM) antibodies using standard serological assays. Sociodemographic, occupational, behavioral, and environmental data were collected through structured questionnaires. Associations between variables and HAV seropositivity were evaluated using chi-square tests. Overall, 81 participants (40.5%) were positive for HAV-specific IgG antibodies, indicating past exposure, while 6 (3.0%) tested positive for IgM, suggesting recent infection. Gender differences were not statistically significant ($p > 0.05$). Significant associations were observed between HAV seropositivity and education level ($\chi^2 = 10.84$, $p < 0.05$), occupation ($\chi^2 = 12.02$, $p < 0.05$), and environmental/behavioral risk factors, particularly consumption of untreated water and street-vended food ($\chi^2 = 14.63$, $p < 0.01$). Seropositivity increased progressively with age, reflecting cumulative lifetime exposure. HAV infection remains endemic in Maiduguri, with high IgG prevalence and low levels of recent transmission. Education, occupation, and hygiene-related behaviors significantly influenced antibody distribution, highlighting the role of environmental and behavioral risk factors in sustaining transmission. Public health interventions should prioritize safe water access, hygiene education, and targeted vaccination for high-risk groups. Being hospital-based, findings may not fully represent community-wide HAV transmission patterns.

1. Introduction

Hepatitis A virus (HAV) infection remains a major public health concern in many developing countries where poor sanitation, inadequate access to clean water, and overcrowded living conditions support continuous fecal–oral transmission, (Papka et al., 2025a). HAV, a non-enveloped single-stranded RNA virus of the Picornaviridae family, is primarily spread through ingestion of contaminated food or water or through direct person-to-person contact. Following infection, the virus replicates in the liver and is shed in stool, contributing to environmental contamination and facilitating community-level transmission. Although HAV infection occurs worldwide, the burden is significantly higher in low- and middle-income countries where childhood exposure is common due to poor hygiene and sanitation. In such settings, most infections occur early in life and are often asymptomatic, resulting in lifelong immunity, (Jacobsen & Wiersma, 2020; Papka et al., 2026c). In contrast, regions with improved sanitation tend to experience delayed exposure and more symptomatic infections, with increased risk of outbreaks.

In Nigeria, HAV remains endemic, with persistent transmission linked to inadequate water purification, unsafe food handling, and poor waste disposal systems, (Adewale et al., 2021). Northern Nigeria, in particular, continues to face higher infection rates due to infrastructural challenges, population displacement, limited access to safe drinking water, and overcrowded living environments, (Yusuf et al., 2020). Despite these factors, HAV is underreported, and only a few studies have assessed its seroepidemiology in northern states (Mohammed et al., 2022; Papka et al., 2025a). University of Maiduguri Teaching Hospital (UMTH) serves as a major referral center for Borno State and surrounding regions, receiving patients from rural, peri-urban, and urban communities. This diverse patient population provides a unique opportunity to evaluate HAV exposure patterns across different demographic and environmental backgrounds. Assessing HAV-specific immunoglobulin M (IgM) and immunoglobulin G (IgG) antibodies among UMTH attendees can therefore offer valuable insights into both recent and past infections in the wider population, (Papka et al., 2025a).

However, despite the public health relevance, up-to-date data on HAV seroprevalence and associated risk factors in Northeast Nigeria are scarce. Little is known about the current burden of infection, the proportion of the population with immunity, or the demographic and environmental determinants that influence exposure in this region. To address this gap, the present study investigates the seroprevalence of HAV-specific antibodies and associated risk factors among patients attending UMTH. The

findings will support evidence-based public health planning, guide potential vaccination strategies, and inform hygiene and sanitation interventions aimed at reducing HAV transmission in Northern Nigeria, (Papka et al., 2025b).

1.1 Aim of the Study

The aim of this study is to determine the seroprevalence of Hepatitis A Virus (HAV) antibodies among patients attending University of Maiduguri Teaching Hospital, Northeast Nigeria

1.2 Objectives of the Study

The specific objectives of this study were to:

- determine the seroprevalence of Hepatitis A Virus (HAV) among patients attending University of Maiduguri Teaching Hospital,
- assess the distribution of HAV-specific antibodies among patients according to gender.
- evaluate the relationship between marital status and HAV seropositivity among the study participants.
- determine the association between educational status and the seroprevalence of HAV antibodies.
- assess the influence of occupational status on HAV antibody prevalence among the participants.

1.3 Statement of the Problem

Hepatitis A Virus (HAV) infection remains a major public health concern worldwide, particularly in developing countries where poor sanitation, inadequate access to clean water, overcrowding, and low socioeconomic conditions contribute significantly to its transmission. HAV is primarily transmitted through the fecal–oral route, usually by ingestion of contaminated food or water or through close contact with infected individuals. Although the infection is often self-limiting, it can result in severe liver complications, prolonged illness, and significant economic burden, especially among adults. In Nigeria, the burden of HAV infection is still considerable due to challenges associated with environmental sanitation and public health infrastructure. Despite the endemic nature of the disease, there is limited recent epidemiological data on the seroprevalence of HAV antibodies among hospital patients in Northeast Nigeria, particularly in University of Maiduguri Teaching Hospital. The lack of adequate information on the prevalence and associated risk factors of HAV infection makes it difficult for health authorities to develop effective preventive and control measures. Furthermore, increasing population movement, internally displaced persons (IDP) camps, overcrowding, and poor hygiene conditions in Northeast Nigeria due to insecurity may contribute to increased transmission of HAV infection. Therefore, there is a need to assess the seroprevalence of HAV antibodies among patients attending the hospital in order to provide baseline data that can support public health interventions, awareness programs, and policy formulation aimed at reducing the spread of HAV infection in the region.

2. Materials and Methods

2.1 Study Area

Maiduguri is situated in the Sahel Savannah region of northeastern Nigeria, between latitudes 10° 50'30" N and 13° 47'45" N and longitudes 12°5'45" E, 23°8'30" E, and 15°11'15" E. It is 50,778 square kilometers in size. Maiduguri Metropolis is bordered to the north by Jere Local Government Area (LGA), to the north-east by Mafa L.G.A., to the south by Konduga L.G.A., and to the north and west by Magumeri. With an average annual temperature of 32°C and 650mm of rainfall, Maiduguri has a pleasant climate.

2.2 Study Design and Population

A hospital-based cross-sectional study design was employed. A total of 200 participants attending various outpatient departments were recruited between March and July 2025. Participants of different ages and both sexes were included, provided they gave informed consent.

2.3 Ethical Considerations

Ethical approval for the study was obtained from the Borno State Ministry of Health and Ethical Committee.

2.4 Sample techniques

Random sampling

2.5 Calculating Sample Size

The general formula given by Araoye et al., 2004 was used to compute the sample size.

Finding the sample size was used the general formula.

$Z^2 \times P(1-P)$ equals n.

The intended sample size, n

Z= standard normal deviation, which was typically 1.96 and represents the 95% confidence level.

P is the 1.0% prevalence rate (represented by a proportion as 0.01) (Papka et al., 2025a) in Maiduguri, Borno state.

$1.0-p(1-0.01) = q$

d= precision, or degree of accuracy, was often set at 0.05.

n is equal to $\frac{(1.96)^2 \times 0.01(1-0.01)}{(0.05)^2}$

$3.8416 \times 0.01(0.99)$

0.0025

3.8416×3.96

$n \approx 15.212736$. Approximately 15. A total of 200 blood samples was been collected attrition rate of 10%.

A total of 200 blood samples was collected.

2.6 Sample Collection and Laboratory Analysis

Approximately 5 mL of venous blood was collected aseptically from each participant and centrifuged to obtain serum. The samples were analyzed for HAV-specific IgG and IgM antibodies using the enzyme-linked immunosorbent assay (ELISA) technique with test kits manufactured by Fortress Diagnostics (UK). The procedure followed the manufacturer's instructions, and results were interpreted based on optical density readings.

2.7 Data Analysis

The data generated was analyzed using SPSS, (chi-square) version 21.0. The descriptive statistics value of $P < 0.05$ was considered significant.

3. Results

3.1 Overall Seroprevalence of HAV-specific Antibodies

Out of the 200 participants examined, 81 (40.5%) tested positive for HAV-specific immunoglobulin G (IgG) antibodies, indicating past exposure and long-term immunity. Six (3.0%) were positive for immunoglobulin M (IgM) antibodies, reflecting recent or acute infection, while 113 (56.5%) were negative for both antibodies (Table 1). The predominance of IgG antibodies confirms widespread past exposure and the endemic nature of hepatitis A virus (HAV) infection in the study area.

Table 1. Overall Seroprevalence of HAV-specific Antibodies

Antibody Type	Number Positive (n)	Percentage (%)	Interpretation
IgG only	81	40.5	Past exposure or long-term immunity
IgM only	6	3.0	Recent or acute infection
Negative for both	113	56.5	No detectable HAV antibodies

Note. IgG = Immunoglobulin G; IgM = Immunoglobulin M.

Overall results indicate a predominance of IgG, confirming widespread past exposure and endemicity.

3.2 Seroprevalence of HAV Antibodies by Gender

HAV-specific antibody prevalence was slightly higher among females (43.1%) than males (36.9%), while IgM detection remained low in both groups (Table 2). This difference was not statistically significant ($p > .05$), suggesting comparable environmental exposure among both sexes.

Table 2. Seroprevalence of HAV Antibodies by Gender

Gender	Number Tested (%)	IgG Positive (%)	IgM Positive (%)	Negative (%)
Male	84 (42.0)	31 (36.9)	1 (1.2)	52 (61.9)
Female	116 (58.0)	50 (43.1)	2 (1.7)	64 (55.2)

Statistical Note: No significant difference observed between sexes ($\chi^2 = 0.82$, $p > .05$).

3.3 Seroprevalence of HAV Antibodies by Marital Status

Married participants exhibited a slightly higher seroprevalence (41.3%) than singles (44.8%), while all widowed participants were positive for IgG (Table 3). These results indicate that prolonged household exposure and shared hygiene practices may contribute to increased HAV transmission.

Table 3. Seroprevalence of HAV Antibodies by Marital Status

Marital Status	Number Tested (%)	IgG Positive (%)	IgM Positive (%)
Single	67 (33.5)	30 (44.8)	2 (3.0)
Married	109 (54.5)	45 (41.3)	3 (2.8)
Widowed	4 (2.0)	4 (100.0)	0 (0.0)
Divorced	20 (10.0)	2 (10.0)	1 (5.0)

Observation: Widowed individuals had the highest IgG positivity (100%), suggesting prolonged cumulative exposure.

3.4 Seroprevalence of HAV Antibodies by Educational Status

A decreasing trend in HAV positivity was observed with increasing education level. Participants with tertiary education had the lowest IgM prevalence (1.3%), consistent with improved hygiene awareness. This association was statistically significant ($p < .05$), indicating that education level influences HAV exposure (Table 4).

Table 4. Seroprevalence of HAV Antibodies by Educational Status

Education Level	Number Tested (%)	IgG Positive (%)	IgM Positive (%)
No formal education	40 (20.0)	23 (57.5)	2 (5.0)
Primary	48 (24.0)	25 (52.1)	1 (2.1)
Secondary	68 (34.0)	24 (35.3)	2 (2.9)
Tertiary	44 (22.0)	9 (20.4)	1 (1.3)

Statistical Note: Association between education level and HAV seropositivity was statistically significant ($\chi^2 = 10.84$, $p < .05$).

3.5 Occupational Influence

Occupational status was significantly associated with HAV antibody prevalence ($p < .05$). Individuals employed in food handling, healthcare, and sanitation work exhibited higher IgG positivity ($\geq 50\%$) compared to students and office workers (Table 5). These findings highlight occupational exposure as an important determinant of HAV infection risk.

Table 5. Seroprevalence of HAV Antibodies by Occupation

Occupation	Number Tested (%)	IgG Positive (%)	IgM Positive (%)
Food handlers	30 (15.0)	16 (53.3)	2 (6.7)
Healthcare workers	28 (14.0)	14 (50.0)	1 (3.6)
Sanitation workers	20 (10.0)	10 (50.0)	1 (5.0)
Students	60 (30.0)	18 (30.0)	1 (1.7)
Office workers	62 (31.0)	23 (37.1)	1 (1.6)

Statistical Note: Occupational status was significantly associated with HAV seropositivity ($\chi^2 = 12.02$, $p < .05$). Food handlers and sanitation workers had the highest exposure rates.

3.6 Seroprevalence of HAV Antibodies by Age Group

Age-specific seroprevalence patterns showed that antibody positivity increased with age (Table 6). Participants aged 41–50 years recorded the highest IgG seroprevalence (50.0%), followed by those above 50 years (46.2%), suggesting accumulated immunity due to past exposure. Younger individuals (< 20 years) demonstrated lower antibody levels (22.7%), reflecting changing epidemiologic trends toward delayed exposure.

Table 6. Seroprevalence of HAV Antibodies by Age Group

Age Group (years)	Number Tested (%)	IgG Positive (%)	IgM Positive (%)
< 20	22 (11.0)	5 (22.7)	1 (4.5)
21–30	40 (20.0)	13 (32.5)	1 (2.5)
31–40	52 (26.0)	22 (42.3)	2 (3.8)
41–50	34 (17.0)	17 (50.0)	1 (2.9)
> 50	52 (26.0)	24 (46.2)	1 (1.9)

Observation: Seropositivity increased significantly with age, suggesting cumulative exposure across life stages.

3.7 HAV Seroprevalence by Behavioral and Environmental Risk Factors

Participants who consumed untreated water or street-vended foods showed significantly higher HAV seropositivity (57.4%) compared to those consuming treated water and home-cooked meals ($p < .01$). This finding underscores the fecal–oral transmission pathway of HAV (Table 7).

Table 7. HAV Seroprevalence by Behavioral and Environmental Risk Factors

Risk Factor	Category	Number Tested	IgG Positive (%)	IgM Positive (%)
Source of drinking water	Treated	74	21 (28.4)	1 (1.4)
	Untreated	126	60 (47.6)	5 (4.0)
Food consumption habit	Home-cooked	88	27 (30.7)	1 (1.1)
	Street-vended	112	54 (48.2)	4 (3.6)

Statistical Note: Participants consuming untreated water or street food had significantly higher seropositivity ($\chi^2 = 14.63$, $p < .01$).

4. Discussion

The study provided a detailed understanding of HAV seroprevalence among patients in Maiduguri, showing a high prevalence of IgG (40.5%) and a low rate of IgM detection (3.0%). These findings confirmed the endemic nature of HAV in Northeast Nigeria and were consistent with reports from other developing regions (Adewale et al., 2021; Mohammed et al., 2022).

The predominance of IgG antibodies indicated that most infections occurred during childhood, thereby conferring long-term immunity. The low IgM rates suggested limited ongoing transmission, which aligned with Papka et al., (2025a), who reported a 1.0% IgM prevalence in Maiduguri. These findings emphasized that HAV continues to circulate, although at lower levels due to gradual improvements in hygiene and sanitation.

Gender-based analysis revealed slightly higher seropositivity among females (39.3%) compared to males (36.4%), consistent with findings by Yusuf et al., (2020) in Borno and Bauchi States. This pattern may be attributed to gender roles in food preparation and water use, which increase exposure risk. However, global studies from Ghana (Mensah et al., 2021) and Kenya, (Odhiambo et al., 2020) reported no significant gender differences, suggesting that exposure is largely influenced by environmental factors.

Variations across occupations highlighted the role of occupational hazards in HAV transmission. Healthcare and sanitation workers were found to have higher antibody prevalence, in agreement with Hassan and Peters (2019) and Gebremedhin et al. (2020), who reported increased HAV seropositivity among healthcare professionals in Nigeria and Sudan. These findings underscored the importance of implementing occupational vaccination programs.

The inverse relationship between educational level and HAV seroprevalence supported the well-established link between socioeconomic status and infection risk, (Bello & Yakubu, 2021; WHO, 2023). Education enhances hygiene awareness and improves access to clean water, thereby reducing exposure. In the same vein, the observed increase in IgG prevalence with age reflected cumulative lifelong exposure, consistent with reports by Johnson and Musa, (2020) and national data from the Federal Ministry of Health, (2022).

Furthermore, analysis of risk behaviors confirmed that the consumption of untreated water and street-vended food significantly increased the risk of infection, corroborating findings from Adamu et al., (2023) in Northern Nigeria and Singh et al., (2021) in India.

5. Conclusion

In Northeast Nigeria, hepatitis A virus infection is still a serious endemic health concern. High IgG seroprevalence indicates extensive prior exposure, but low IgM positive suggests little recent transmission. HAV exposure patterns are significantly influenced by sociodemographic and behavioral characteristics, including education, occupation, and sanitation.

6. Recommendations

The following recommendations were made:

- It was recommended that routine Hepatitis A Virus (HAV) vaccination be incorporated into Nigeria's immunization schedule, particularly for children and individuals in high-risk occupational groups.
- It was also suggested that hygiene education programs be strengthened, with a focus on food handlers, healthcare workers, and the general public.
- Furthermore, it was advised that access to clean water and improved sanitation infrastructure be enhanced in both urban and rural areas.
- Finally, it was recommended that continuous HAV surveillance be conducted to monitor changing epidemiological trends.

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