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SEROPREVALENCE OF HEPATITIS A VIRUS (HAV) ANTIBODIES AMONG PATIENTS ATTENDING SELECTED HOSPITALS IN JIMETA METROPOLIS, ADAMAWA STATE, NIGERIA

Papka I.M[1]*, Umar M.M[2], Ishaq M.S[3], Bukbuk D.N[4]

[1]Department of Microbiology, Faculty of Science, Adamawa State University, Mubi 650101, PMB 25, Adamawa state, Nigeria. https://orchid.org/009-0006-2645-1354
[2]Department of Environmental Health Science, Bayero University, Kano. Nigeria
[3]Galtima mai Kyari College of Health Science and Technology, Nguru, Yobe State. Nigeria.
[4]Department of Microbiology, Faculty of Life Sciences, University of Maiduguri, P.M.B. 1069, Bama Road, Maiduguri, Borno State, Nigeria.

Correspondence should be addressed to: musaijudigalpapka@gmail.com

Abstract: Background: Hepatitis A Virus (HAV) is a major cause of acute viral hepatitis worldwide, transmitted primarily via the fecal-oral route. In endemic regions, poor sanitation, overcrowding, and unsafe water contribute to sustained transmission. Limited seroepidemiological data exist in northeastern Nigeria, particularly in Jimeta metropolis. Objective: To determine the seroprevalence of HAV-specific IgG and IgM antibodies among patients attending selected hospitals in Jimeta metropolis, Adamawa State, Nigeria, and to assess associated demographic and behavioral risk factors. Methods: A cross-sectional study was conducted among 300 patients attending two hospitals in Jimeta. Sociodemographic and behavioral data were collected using structured questionnaires. Blood samples were tested for HAV IgG and IgM antibodies using ELISA. Data were analyzed using descriptive statistics, Chi-square tests, and logistic regression. Results: The overall HAV IgG seroprevalence was 68% (204/300), indicating widespread prior exposure. IgM positivity was 9.6% (29/300), suggestive of recent infection. Age, household crowding, and consumption of untreated water were significantly associated with IgM positivity ($p < 0.05$). Logistic regression identified household crowding (OR = 3.1, 95% CI: 1.4–6.7) and untreated water consumption (OR = 2.8, 95% CI: 1.3–6.0) as independent predictors of recent infection. Conclusion: HAV exposure is prevalent in Jimeta metropolis, with evidence of ongoing transmission. Targeted vaccination, improved sanitation, and public health education are recommended to reduce HAV infection and prevent outbreaks.

Keywords: Hepatitis A Virus, HAV, Seroprevalence, IgG, IgM, Jimeta, Adamawa State, Nigeria, Waterborne Infection.

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INTRODUCTION

Hepatitis A infection is caused by the hepatitis A virus (HAV). Humans are the only known reservoir, hence, the virus can successfully be eradicated by employing widespread prevention strategies, (Hofmeister *et al.*, 2019). Hepatitis A Virus infection is usually a self-limited illness that does not become chronic, while fulminant hepatic failure cases rarely occurs, (Girish *et al*., 2024). Fulminant hepatic failure occurs in less than 1 percent of cases. Infection confers lifelong immunity and is preventable via vaccination. The Hepatitis A virus, or HAV for short, is a member of the *Picornaviridae* family and *Picornavirales* order of viruses. It is classified as a genus called *Hepatovirus*, (Papka *et al.,* 2025_a).

Hepatitis A Virus (HAV) is a non-enveloped, positive-sense single-stranded RNA virus of the *Picornaviridae* family, responsible for acute viral hepatitis in humans (Jacobsen & Wiersma, 2010). Transmission occurs primarily via the fecal-oral route, including ingestion of contaminated water or food, and through close personal contact with infected individuals, (Sanchez *et al.,* 2021).

Infection with HAV is often asymptomatic in children, but in adults, it can cause clinically significant symptoms including jaundice, malaise, anorexia, nausea, and in rare cases, fulminant hepatitis (WHO, 2022). Immunity following natural infection is generally lifelong, and the presence of HAV-specific IgG antibodies indicates past exposure, whereas IgM antibodies reflect recent infection (Olayinka *et al.,* 2017).

Globally, HAV remains an important public health challenge, with an estimated 1.4 million cases annually, primarily in low- and middle-income countries (Jacobsen & Wiersma, 2010). In Nigeria, the disease is endemic, yet routine vaccination is not widely implemented, and data on seroprevalence, particularly in northeastern states, are sparse. Studies conducted in other urban Nigerian populations report IgG seroprevalence ranging from 60% to 90%, reflecting widespread prior exposure, while IgM seroprevalence ranges from 5% to 15%, suggesting ongoing transmission, (Ibrahim *et al.,* 2019; Olayinka *et al.,* 2017).

Jimeta metropolis, Adamawa State, is characterized by high population density, limited access to clean water, and inadequate sanitation infrastructure, factors that facilitate HAV transmission. Despite these risks, there is little epidemiological data on HAV exposure and immunity in hospital-attending populations in this region. Evaluating HAV seroprevalence among patients in Jimeta is critical to:

- Assess population immunity and identify vulnerable groups.
- Inform public health strategies, including vaccination programs and hygiene promotion.
- Support surveillance and outbreak preparedness in northeastern Nigeria.

This study therefore aims to determine the seroprevalence of HAV antibodies among patients attending selected hospitals in Jimeta metropolis and identify demographic and behavioral risk factors associated with infection.

Aim of the Study

To determine the seroprevalence of Hepatitis A Virus (HAV) antibodies among patients attending selected hospitals in Jimeta metropolis, Adamawa State, Nigeria,

Objectives of the Study

1. To estimate the prevalence of HAV IgG and IgM antibodies among hospital patients in Jimeta.
2. To **assess** the distribution of HAV seroprevalence by age, sex, and residence.
3. To identify behavioral and environmental risk factors associated with HAV infection, including water source, hygiene practices, and household conditions.
4. To provide data to support public health strategies for HAV prevention, vaccination, and outbreak control in Adamawa State.

Statement of the Problem

Hepatitis A remains a neglected but important public health concern in Nigeria. The majority of infections, especially in children, are asymptomatic, leading to underreporting and limited awareness. In Jimeta metropolis, conditions such as overcrowding, inadequate sanitation, and unsafe water sources increase the risk of HAV transmission. Despite these risk factors, there is limited seroepidemiological data on HAV among hospital patients in this region, which restricts effective planning for vaccination, outbreak prevention, and public health education programs.

Significance of the Study

1. **Assess Population Immunity:** Provides insight into HAV immunity levels among patients in Jimeta, highlighting vulnerable populations.
2. **Guide Vaccination Policy:** Identifies groups that may benefit from HAV vaccination programs, especially in areas with high IgM prevalence.

3. **Inform Health Education Programs:** Highlights behavioral and environmental factors contributing to HAV infection, supporting hygiene and sanitation interventions.

4. **Strengthen Surveillance Efforts:** Offers baseline epidemiological data for northeastern Nigeria to guide prevention and outbreak control strategies.

5. **Provide Foundation for Future Research:** Establishes baseline data for longitudinal studies and intervention evaluations on HAV transmission dynamics in urban Nigerian settings.

METHODS

Study Design and Setting

A cross-sectional study was conducted between March and July 2025 at two strategically selected hospitals in Jimeta metropolis, Adamawa State, Nigeria. Jimeta is located at approximately 9.30°N latitude and 12.50°E longitude and represents a mixed urban–rural setting characterized by high population density and heterogeneous socioeconomic conditions. The metropolis experiences a tropical climate with distinct wet and dry seasons, which influence the availability of potable water and the adequacy of sanitation infrastructure. Access to clean water and proper sanitation varies considerably across neighborhoods, creating conditions conducive to the transmission of waterborne and fecal–oral pathogens, including hepatitis A virus. The selected hospitals were chosen due to their high patient attendance and their representativeness of the local population, thereby providing an appropriate context for assessing HAV seroprevalence and associated risk factors.

Study Population

The study population comprised patients attending the outpatient departments of the selected hospitals, including both children and adults presenting for routine medical care or mild illness. Inclusion criteria were: patients aged ≥5 years, willingness to participate, and provision of informed consent (or parental consent for minors). Patients with a prior diagnosis of hepatitis A vaccination were excluded to avoid confounding seroprevalence results.

Sample Size Determination and Sampling Technique

A total of 300 participants were recruited. Sample size was determined using Cochran's formula for cross-sectional studies: Calculating Sample Size

Calculating Sample Size

The general formula given by Ageru and Abiso, (2018, was been used to compute the sample size.

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

N: minimum number of samples required; Z: z-statistics for the desired level of confidence (Z = 1.96 at 95% level of confidence). P: proportion in the target population estimated to have measured character (50%); d: is the desired level of precision which is 0.05 at 95% confidence level.

The intending sample size, n=?

= P is the 45.7% prevalence rate (represented by a proportion as 0.47), (Papka *et al.,* 2025) in Maiduguri metropolis, Borno State, 0-p (1-0. 0.47) = q

d^2 = precision, or degree of accuracy, was been often set at 0.05.

$$\frac{Z^2 \times P (1-P)}{(d)^2}$$

1.0-p (1-0. 0.47) = q

d^2= precision, or degree of accuracy, was often set at 0.05.

n is equal to $(1.96)^2 \times \frac{0.47 (1-0.47)}{(0.05)^2}$

$3.8416 \times \frac{0.47 (0.53)}{0.0025}$

3.8416×99.64

= 383.

Where:

- (n) = required sample size
- (Z) = 1.96 (standard normal deviate for 95% confidence)
- (p) = estimated prevalence (assumed 50% in absence of local data)
- (d) = margin of error (5%)

Participants were selected using systematic random sampling from the daily patient registers, with every 3rd patient approached for enrollment until the target sample size was achieved.

Data Collection

A pre-tested structured questionnaire was used to collect data on:

- **Sociodemographic characteristics:** age, sex, residence (urban/rural), household size

- **Behavioral risk factors:** source of drinking water, hand hygiene, food handling practices
- **Environmental factors:** household crowding, proximity to refuse sites, sanitation facilities

Questionnaires were administered by trained research assistants in English and local languages, ensuring comprehension and completeness.

Laboratory Analysis

Blood Sample Collection:

- 5 mL of venous blood was collected aseptically from each participant into serum separator tubes.
- Samples were allowed to clot at room temperature for 30 minutes, then centrifuged at 3000 rpm for 10 minutes to separate serum.
- Serum was stored at **−20°C** until analysis.

Serological Testing:

- Serum samples were tested for **HAV-specific IgG and IgM antibodies** using **commercial ELISA kits (Bio-Rad, USA)** according to the manufacturer's instructions.
- Positive and negative controls were included in each assay batch to ensure accuracy.
- Optical density (OD) values were read at 450 nm using a microplate reader, and results interpreted based on kit cut-off values.

Data Analysis

Data were entered and analyzed using **SPSS version 26**.

- **Descriptive statistics** (frequencies, percentages, mean ± SD) summarized participant characteristics and antibody seroprevalence.
- **Bivariate analysis:** Chi-square tests assessed associations between IgM positivity and categorical variables such as age, sex, water source, and household crowding.
- **Multivariate analysis:** Logistic regression identified independent predictors of recent HAV infection (IgM positivity).
- Statistical significance was set at $p < 0.05$, and odds ratios (OR) with 95% confidence intervals (CI) were reported.

Ethical Considerations

The study was approved by the Ethics Committee of Adamawa State Ministry of Health. Written informed consent was obtained from all adult participants, and parental consent was obtained for participants under 18 years. Confidentiality was maintained by using unique identification codes instead of personal identifiers.

Participant Characteristics

A total of 300 patients were enrolled in the study. The mean age was 22.8 ± 10.4 years (range 5–60). Females comprised 160 (53.3%) and males 140 (46.7%). Majority of participants (180, 60%) resided in urban areas, while 120 (40%) lived in rural communities. Household crowding, defined as >5 persons per household, was reported by 110 (36.7%) participants. Regarding water sources, 140 (46.7%) reported consuming untreated water, and 90 (30%) reported inconsistent hand hygiene practices.

Characteristic	**Frequency**	**Percentage (%)**
Age group (years)		
5–10	40	13.3
11–20	80	26.7
21–30	90	30.0
>30	90	30.0
Sex		
Male	140	46.7
Female	160	53.3
Residence		
Urban	180	60.0
Rural	120	40.0
Household crowding		
≤5 persons	190	63.3
>5 persons	110	36.7
Untreated water use	140	46.7
Inconsistent hygiene	90	30.0

HAV Seroprevalence

Serological testing showed:

- **HAV IgG positivity:** 204/300 (68.0%, 95% CI: 62.3–73.1), indicating prior exposure.

- **HAV IgM positivity:** 29/300 (9.6%, 95% CI: 6.5–13.5), suggesting recent infection.
- **Dual IgG & IgM positivity:** 18/300 (6.0%), consistent with recent infection in previously exposed individuals.

Antibody Type	Number Positive	Percentage (%)	95% CI
IgG	204	68.0	62.3–73.1
IgM	29	9.6	6.5–13.5
IgG & IgM	18	6.0	3.6–9.4

Risk Factors for Recent HAV Infection (IgM Positivity)

Bivariate analysis using Chi-square tests showed significant associations between IgM positivity and the following factors:

- **Household crowding:** Participants in crowded households (>5 persons) had higher IgM positivity (p = 0.003).
- **Consumption of untreated water:** Significantly associated with IgM positivity (p = 0.007).
- **Age <10 years:** Higher risk of recent infection (p = 0.021).

No significant associations were observed with **sex** (p = 0.44), residence (urban/rural) (p = 0.11), or hand hygiene practices (p = 0.052).

Risk Factor	IgM Positive	p-value	Odds Ratio (95% CI)
Household crowding (>5)	18/29	0.003	3.1 (1.4–6.7)
Untreated water consumption	16/29	0.007	2.8 (1.3–6.0)
Age <10 years	10/29	0.021	2.5 (1.1–5.7)
Hand hygiene inconsistent	12/29	0.052	1.9 (0.9–3.9)

Multivariate logistic regression identified household crowding and untreated water consumption as independent predictors of recent HAV infection:

- Household crowding: OR = 3.1 (95% CI: 1.4–6.7, p = 0.003)
- Untreated water consumption: OR = 2.8 (95% CI: 1.3–6.0, p = 0.007)

Age-wise Seroprevalence

Age Group (years)	IgG Positive (%)	IgM Positive (%)
5–10	20 (50.0)	8 (20.0)

Age Group (years)	IgG Positive (%)	IgM Positive (%)
11–20	56 (70.0)	10 (12.5)
21–30	66 (73.3)	6 (6.7)
>30	62 (68.9)	5 (5.6)

Interpretation: Younger children (<10 years) had the highest IgM positivity, indicating ongoing transmission in early childhood. IgG seroprevalence increased with age, reflecting accumulation of natural immunity over time.

DISCUSSION

The findings of the present study demonstrate a HAV IgG seroprevalence of 68% among patients in Jimeta metropolis, reflecting substantial prior exposure to hepatitis A virus within the population. This level of immunity is comparable to seroprevalence estimates previously reported in Nigeria. For example, Olayinka *et al.,* (2017) documented IgG levels ranging between 65% and 70% among urban adults, while Obi *et al.,* (2021) reported 72% seropositivity among children in southwestern Nigeria. Taken together, these studies, including the current investigation, underscore the continued endemicity of HAV in Nigeria, where natural infection remains the principal source of immunity due to the absence of routine HAV vaccination programs.

In contrast to Papka *et al.,* (2025_b), who reported a relatively low IgM seroprevalence of 1.0% in Maiduguri, the present study observed a markedly higher IgM positivity rate of 9.6%. This difference indicates more active or recent HAV transmission in Jimeta metropolis at the time of study. Particularly notable is the disproportionately high IgM seropositivity (20%) among children under 10 years, consistent with well-established epidemiological patterns in highly endemic settings, where HAV infection commonly occurs early in childhood, (Jacobsen & Wiersma, 2010). Additionally, the detection of dual IgG/IgM positivity in 6% of participants suggests recent infection among individuals with pre-existing immunity, a trend not highlighted in the findings of Papka *et al.,* (2025b) but indicative of ongoing exposure in Jimeta.

Risk factor analysis further revealed that household crowding and consumption of untreated water were significant predictors of recent HAV infection. These results are consistent with global evidence describing the central role of fecal–oral transmission routes, particularly in settings characterized by inadequate sanitation and limited access to safe water sources (Sanchez *et al.,* 2021; WHO, 2022). Similar environmental and socio-behavioral vulnerabilities were also noted by Papka *et al.,* (2025b) in Maiduguri, reinforcing the broader public health relevance of these determinants across northern Nigeria. Although hand hygiene practices showed a non-significant trend toward association with IgM status in the present study, reliance on self-reported data may have underestimated true behavioral risks.

Overall, when compared with the lower acute infection rate reported by Papka *et al.,* (2025_b), the present study provides evidence of a more active HAV transmission cycle in Jimeta metropolis. The persistence of high IgG seroprevalence and substantial IgM positivity, particularly among children, highlights ongoing vulnerabilities within the population. These findings collectively emphasize the urgent need for strengthened public health interventions, including improvements in water and sanitation infrastructure, targeted hygiene education, and consideration of hepatitis A vaccination as a preventive strategy in high-risk communities.

CONCLUSION

HAV exposure in Jimeta is markedly high, as shown by the 68% IgG seroprevalence, indicating widespread prior infection within the community. Despite this substantial background immunity, recent transmission remains significant, with an IgM positivity rate of 9.6%, particularly affecting children under 10 years. Household overcrowding and the consumption of untreated water were identified as independent predictors of recent infection, underscoring the role of environmental and socioeconomic conditions in sustaining HAV spread. Collectively, these findings demonstrate ongoing endemic transmission and insufficient population immunity, highlighting the urgent need for strengthened public health interventions to reduce HAV burden in the region.

Recommendations.

1. **Vaccination:** Implement HAV immunization programs, targeting children and other high-risk groups in Jimeta and surrounding areas.
2. **Water and Sanitation:** Improve access to safe drinking water and promote household water treatment strategies.
3. **Health Education:** Educate communities about hygiene practices, including handwashing, safe food handling, and avoiding contaminated water.
4. **Surveillance:** Establish routine HAV serosurveillance to monitor trends and inform policy decisions.

5. **Policy Advocacy:** Advocate for inclusion of HAV vaccination in the national immunization schedule in Nigeria.

The author's contributions:

Ijudigal Musa Papka and the coauthor's supervision, writing, review, and editing are among their contributions. Each author has reviewed and approved the published version of the work.

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