# Frequency of Hepatitis A Virus among Children in Diyala Governorate

**Hayder Muthana Shafiq (Undergraduate)[1], Areej Atiyah Hussein (Ph.D.)[2]**

1, 2, University of Diyala- College of Medicine

## Abstract

**Background:** Hepatitis A infections is serious public health threats around the world, among children play important roles and considered vital reservoirs for acute hepatitis A

**Objective:** To determine the frequency of hepatitis A virus among children in Diyala Governorate.

**Patients and methods:** Cross sectional study were conducted in the Batool Teaching Hospital for Maternity and Children during the period from 1st January 2022 till 31 December 2022. All study population (1391) under to Hepatitis A virus detection using enzyme linked immunosorbant assay as well as make interview for each participant to collect demographic and clinical data

**Results:** The infection rate was 21.42%, the frequency of infection was more common in males 161(54.02%) than females 137(45.98%). Regarding the seasonal variation the rate was more common during February, April, May, July, September and October compared to winter 25.64%, 24.52%, 20.75%, 34.28%, 20.66% and 30% respectively The rate showed high percentage among age group (2 month -5 years) 50.33% followed by age group (6-10) and (11-15) years. High percentages were notice in area around Baqubah city 164(55.03%) than in Baqubah 134(44.97%)

**Conclusion:** Hepatitis A virus seroprevalence in Iraq has been declining since the past decade especially in children less than 10 years, indicating intermediate-to-low endemicity of hepatitis A virus. However, people are still many susceptible, indicating the need for hepatitis A virus vaccination in the country.

**Keywords:** Hepatitis A virus, ELISA, epidemiology, prevalence

## Introduction

Acute viral hepatitis is a systemic infection affecting the liver predominantly. One of five viral agents causes almost all cases of acute viral hepatitis: hepatitis A virus (HAV), HBV, HCV, the HBV-associated delta agent or HDV and HEV. All these human hepatitis viruses are RNA viruses, except for hepatitis B, which is a DNA virus but replicates like a retrovirus [1].

Hepatitis A is the most common form of acute viral hepatitis in developing countries. In children < 6 years of age, most infections are asymptomatic, and if illness does occur, it is usually anicteric [2]. It is estimated 1.5 million cases diagnosed each year globally [3]. Hepatitis A endemicity is intimately linked to hygienic and sanitary conditions, as well as other markers of socioeconomic development. HAV infection is highly endemic in developing countries with low sanitary and hygienic conditions, household crowding, and insufficient water supply [4].

Hepatitis A virus is a positive-strand RNA virus classified within the family *Picornaviridae*. The mature HAV virion is a small 27 nm, generally spherical, non-enveloped particle [5]. Four of the seven genotypes of HAV affect humans (genotypes I and III are the most common), but only one serotype exists. Infection with any of the genotypes usually results in lifelong immunity [6].

Spread of infection is generally person to person or by oral intake after fecal contamination of skin or mucous membranes; less commonly, there is fecal contamination of food or water [7]. Persons with hepatitis A can shed the virus in their stool beginning several weeks before the onset of symptoms. The viral concentration in stool is highest in the prodromal phase. For those who develop symptoms, the viral concentration is usually very low by the time jaundice appears and undetectable before symptoms resolve [8][9].

The incubation period of hepatitis A is 2-6 weeks. Children with hepatitis A usually do not have any clinical symptoms, while adults experience nausea, weight loss, and jaundice. In some cases, hepatitis A may progress to acute hepatic failure or fulminant hepatitis [10].

Several studies from Iraq and abroad have reported a varying prevalence so this study design to determine the frequency of hepatitis A virus among children in Diyala Governorate.

## Patients and methods

Study design: Cross sectional study were conducted in the Batool Teaching hospital for children during the period from 1st January 2022 till 31st December 2022.

## Sample Collection and Processing

Children are presented with acute onset of low-grade fever (< 38.5 °C), vomiting, diarrhea, nausea, malaise, abdominal pain, and normal-colored urine. Only children with elevated transaminases were recruited. All samples were tested for qualitative determination of IgM-class antibody to hepatitis A virus in human serum using enzyme linked immunosorbant assay (DIALAB, HAV-IgA, Ref Z08372, Austria) as well as interview for each participant to collect demographic and clinical data.

## Statistical analysis

All date are summarized as number and percentages.

## Results

A total of 1391 serum samples from clinically suspected cases of AVH were received from January 2022 to December 2022. Of the specimens, 298 (21.42%) were positive for IgM anti-HAV antibodies. Regarding the seasonal variation the rate was more common during February, April, May, July, September and October compared to winter 25.64%, 24.52%, 20.75%, 34.28%, 20.66% and 30% respectively as shown in (Table 1).

**Table 1:** Distribution of HAV among study population during 2022.

| Months | Examine No. | Infected No. | Percentage |
|---|---|---|---|
| January | 0 | 0 | 0 |
| February | 78 | 20 | 25.64% |
| March | 158 | 25 | 15.82% |
| April | 53 | 13 | 24.52% |
| May | 106 | 22 | 20.75% |
| June | 182 | 34 | 18.68% |
| July | 140 | 48 | 34.28% |
| August | 338 | 51 | 15.08% |
| September | 121 | 25 | 20.66% |
| October | 70 | 21 | 30% |
| November | 56 | 10 | 17.85% |
| December | 89 | 29 | 32.58% |
| Total | 1391 | 298 | 21.42% |

Distribution of HAV infection in children according to gender demonstrating that percentage in males 54.02% more than in females 45.98% as shown in (Table 2).

**Table 2:** Gender distribution among study population during 2022.

| Gender | No. Positive cases | Percentages |
|---|---|---|
| Males | 161 | 54.02% |
| Females | 137 | 45.98% |
| Total | 298 | 100% |

According to age distribution, their age of positive HAV cases ranged between 2 months-15 years. The rate showed high frequency among age group (2 month -5 years) 150(50.33%), while the remaining in age group (6-10) and (11-15) years respectively as shown in (Table 3).

**Table 3:** Distribution of syphilis according to age in study population

| Age (years) | No. Positive cases | Percentages |
|---|---|---|
| 2 month -5 years | 150 | 50.33% |
| 6-10 years | 109 | 36.57% |
| 11-15 years | 39 | 13.10 |
| Total | 298 | 100% |

Frequency of HAV infection in children according to residency demonstrating that 164 (55.03%) in Around Baqubah more than in 134(44.97%) Baqubah as shown in (Table 4).

**Table 4:** Residence distribution among study population.

| Residence | No. Positive cases | Percentages |
|---|---|---|
| Baqubah | 134 | 44.97% |
| Around Baqubah | 164 | 55.03% |
| Total | 298 | 100% |

## Discussion

The result of current study reported the infection rate of AVH during January 2022 to December 2022 was 21.42% were positive for IgM anti-HAV antibodies. This result comparable with study in Mosul City reported that the prevalence of HAV IgM was 21.7% in 2020 [11]. This results show an intermediate-to-low endemicity of HAV in Diyala- Iraq; which is different from the earlier report of a high endemicity of HAV, with a seroprevalence of 96.4% [12]. 83.3% in Wasit Province/Iraq in 2015 [13]. 65% in Al-Alwyia pediatric teaching hospital in 2015 [14]. 54.38 % in Babylon province in 2016 [15].Other study done outside Iraq reported 12% in Egypt [16]. The recent development of inactivated and live attenuated hepatitis A vaccines has raised the hope of reducing hepatitis A incidence. With hepatitis A vaccine already licensed in several countries, including the United States, much consideration is being given to which groups to vaccinate [17]. Such wide variation in positivity could be due to the differences in the study population, living standard, sanitation, environmental hygiene, underreporting, and the reluctance of patients seeking medical care and type of samples whether sporadic or from outbreaks.

Regarding the seasonal variation the rate was more common during February, April, May, July, September and October compared to winter 25.64%, 24.52%, 20.75%, 34.28%, 20.66% and 30% respectively. This result agreed with other studies were observed for acute viral hepatitis, with most prominent peaks were shown in spring and summer for hepatitis A; B; C and E. These findings have been explained by some authors as due to summer travel to an endemic area, swimming habits of the population in hot months, poor hygiene and environmental sanitation, and food habits (feco-oral transmission of viral hepatitis) [18][19]. As well as Hepatitis A virus is an extremely stable virus and can survive for 12 weeks to 10 months in water [20][21]. This stability accounts for the frequent occurrence of waterborne and shellfish-transmitted outbreaks [22][23]. In this regard, the virus is relatively resistant to heat or chemical inactivation and this situation allow the dissemination of HAV infection. Therefore, disruption of sanitation and water supplies was the most likely contributing factor for the seasonal occurrence of hepatitis A and E. A number of case reports has described water exposure as a possible risk factor for acquiring HEV infection: Swimming in a lake [24].

In this study, there was a male predominance, which is consistent with several studies done in Iraq and other countries [11][15]16][25][26][27]. Infections with viruses are more prevalent in human males than in females, suggesting that behavioral or occupational exposures contribute to the acquisition of infection or health-seeking behavior in the community [28]. The higher rate of HAV positivity in males in our study may be mainly associated with them being more in contact with the external environment and consuming more unhygienic foods and beverages. Other study reported that seropositivit of HAV was more common in females than males such as [13][29][30]. Other study carried out in Canada by Wu *et al*. reported that males have higher proportion than females in respect to HAV infection [31]. While no sex prediction was appearing in other studies [12][32].

According to age distribution, their age of positive HAV cases ranged between 2 months-15 years. The rate showed high frequency among age group (2 month -5 years) 150(50.33%), followed by age group 6-10 years, this result comparable with other Iraqi studies which reported that most infection occur in children less than 5 years [13][14][25][30]. In this study, the majority of cases belonged to the age group below 10 years. The consumption of food and water from open places and fast-food restaurants in the crowded slum areas with poor hygienic conditions puts this age group at high risk of getting infections [33]. Also the result of current study agreed with WHO report, 2014 which found that in the developing world about 90% of children have been infected by age of 10 years and thus are immune by adulthood [34].

In conclusions. Hepatitis A virus seroprevalence in Iraq has been declining since the past decade especially in children less than 10 years, indicating intermediate-to-low endemicity of hepatitis A virus. However, people are still many susceptible, indicating the need for hepatitis A virus vaccination in the country.

In general, the rate of HAV seropositivity does not differ by residence from other studies and reports from developing and developed countries. We found that the likelihood of HAV seropositivity was higher in area around Baqubah city 164(55.03%) than in Baqubah 134(44.97%) this result agreed with [27][30][35].Poor personal hygiene and health education might be the main reason for the increasing number of HAV cases. Most of migrants' families lived in camps far away from the city center where poor sanitations and limited access to safe drinking water. This may contribute to the incidence of HAV [36][37].

## References

1. Central Bureau of Health Intelligence, Ministry of Health and Family Welfare. National Health Profile. New Delhi, 2016.

2. Yassin NA, El-Houchi SZ, Abd El-Shafy SF, Soliman NS, Elmonem MA and El-Koofy N.

Frequency of Hepatitis A virus as a cause of anicteric hepatitis in children under 5 years:

a common yet under-recognized cause. Egyptian Pediatric Association Gazette; 2022; 70:41.

3. Franco E, Meleleo C, Serino L, Sorbara D, Zaratti L. Hepatitis A epidemiology and prevention in developing countries. World J Hepatol. 2012; 4:68-73.

4.Wasley A, Kruszon-Moran D, Kuhnert W, Simard EP, Finelli L, McQuillan G, Bell B (2010) The prevalence of hepatitis B virus infection in the United States in the era of vaccination. J Infect Dis 202:192–201)

5. Feinstone S.M., Kapikian A.Z., and Purcell R.H. Hepatitis A: detection by immune electron microscopy of a viruslike antigen associated with acute illness. Science 1973; 182:1026–1028.

6. Franco E, Giambi C, Ialacci R, Coppola RC, Zanetti AR. Risk groups for hepatitis A virus infection. Vaccine 2003; 21: 2224-2233.

7. Cuthbert JA. Hepatitis A: old and new. Clin Microbiol Rev 2001; 14: 36-58.

8. Jackobsen KH, Koopman JS. Declining hepatitis A seropre- valence: a global review and analysis. Epidemiol Infect 2004; 132: 1005-22.

9. Ergun GA, Miskovitz PF. Viral hepatitis: the new ABC's. Postgrad Med. 1990; 88(5):69-76.

10. Jung YK, Kim JH. Epidemiology and clinical features of acute hepatitis A: from the domestic perspective. Korean J Hepatol. 2009;15: 438–445.

11. Daood II, Ibrahim RH. Seroprevalence of Hepatitis A Virus (HAV) in Mosul City. Medico-legal Update, 2020, 20(1):

12. Turky AM, Akram W, Al-Naaimi, AS, Omer AR, Rawi JRA. Analysis of acute viral hepatitis (A and E) in Iraq. Glob. J. Health Sci.2011;3(1):70‑6. https://doi.org/10.5539/gjhs.v3n1p70

13. Jassim AA, Utba NM, Mohammed WJ. Acute HAV Infected Patient's Distribution According to Age and Sex in Wasit Province/Iraq. Iraqi journal of science 2015; 56(34): 1858-1865.

14. Raham TF, Abood AM. Epidemiological characteristics of acute symptomatic hepatitis A in Al-Alwyia pediatric teaching hospital during 2013. Al-kindy college medical journal. 2015; 11(1): 53-57.

15. Al-Khafaji ZAI, Al-Khafaji, YAK, Hindi NKK. Immunological Study for Hepatitis A virus infected patients in Babylon province / Iraq. Australian Journal of Basic and Applied Sciences. 2016; 10(9): 127-131.

16. Yassin NA, El-Houchi SZ, Abd El-Shafy SF, Soliman NS, Elmonem MA and El-Koofy N. Frequency of Hepatitis A virus as a cause of anicteric hepatitis in children under 5 years: a common yet under-recognized cause. Egyptian Pediatric Association Gazette. 2022; 70:41.

17. Smith PF, Grabau JC, Werzberger A, Gunn RA, Rolka HR,Kodracki SF, Gallo RJ and Mores DL. The role of young children in a community-wide outbreak of hepatitis A. Epidemiol. Infect. (1997), 118, 243±252.

18. Al-Naaimi AS, Turky AM, Khaleel HA, Jalil RW, Mekhlef OA, Kareem SA, et al. Predicting acute viral hepatitis serum markers (A and E) in patients with suspected acute viral hepatitis attending primary health care centers in Baghdad: A one year cross-sectional study. Glob J Health Sci 2012; 4:172-83.

19. Villar LM, De Paula VS, Gaspar AM. Seasonal variation of hepatitis A virus infection in the city of Rio de Janeiro, Brazil. Rev Inst Med Trop Sao Paulo 2002; 44:289-92.

20. Biziagos E, Passagot J, Crance JM, Deloince R. Long-term survival of hepatitis A virus and poliovirus type 1 in mineral water. Appl Environ Microbiol 1988; 54:2705-10.

21. Sattar SA, Jason T, Bidawid S, Farber J. Foodborne spread of hepatitis A: Recent studies on virus survival, transfer and inactivation. Can J Infect Dis 2000; 11:159-63.

22. Velázquez O, Stetler HC, Avila C, Ornelas G, Alvarez C, Hadler SC, et al. Epidemic transmission of enterically transmitted non-A, non-B hepatitis in Mexico, 1986-1987. JAMA 1990; 263:3281-5.

23. Yao G. Clinical spectrum and natural history of viral hepatitis A in a 1988 Shangai epidemic. In: Hollinger BN, Lemon SM, Margolis HS, editors. Viral Hepatitis and Liver Disease. Baltimore: Williams and Wilkins; 1991. p. 76-8.

24. Moucari R, Bernuau J, Nicand E, Cazals-hatem D, Valla D, Marcellin P, et al. Acute hepatitis E with severe jaundice: Report of three cases. Eur J Gastroenterol Hepatol 2007; 19:1012-5.

25. Al-Azzawi SI, Al- Zubaidi MA, Aziz HA. Hepatitis A virus infection in children. Iraqi Journal of Medical Sciences. 2010; 8(2): 51-56.

26. Arankalle V, Mitra M, Bhave S, Ghosh A, Balasubramanian S, Chatterjee S, Choudhury J, Chitkara A, Kadhe G, et al. Changing epidemiology of hepatitis A virus in Indian children Vaccine: Development and Therapy. 2014; 2014-4;7-13.

27. Abdullah I and Goreal A. Seroprevalence of anti-hepatitis A virus antibody in Iraq. EMHJ. 2022; 28(11):

28. Jacobsen H, Klein SL: Sex differences in immunity to viral infections. Front Immunol. 2021,

29. Abbas EC, Al-Saady AT, Al-Khafaji ZA, Kadhum MJ. Association of IL-17 with hepatitis A virus Childhood infection patients less than 10 years old. J. Pharm. Sci. & Res. 10(5), 2018, 1165-1166.

30. Wadday FM, Aljothary AH, Almamoori TJF. Acute viral hepatitis a in children an epidemiological and clinical course in Babylon. Muthanna Medical Journal. 2022; 9(2): 132-145.

31. Wu J, Zou S and Giulivi A. Current hepatitis A status in Canada. Can J Infect Dis. 2001; 12:341-344.

32. Almuneef MA, Memish ZA, Balkhy HH, etal. Epidemiologic shift in the prevalence of Hepatitis A virus in Saudi Arabia: a case for routine Hepatitis A vaccination. Vaccine. 2006 Jul 7; 24(27-28):5599-603.

33. Vitral CL, da Silva-Nunes M, Pinto MA, de Oliveira JM, Gaspar AM, Pereira RC, Ferreira MU: Hepatitis A and E seroprevalence and associated risk factors: a community-based cross-sectional survey in rural Amazonia. BMC Infect Dis. 2014, 14:458.

34. World Health Organization. 2014. Hepatitis A Fact sheet 16.N°328. WHO.

35. Merzah MA, Mohammed AA, Al-Aaragi ANH, Salim M. Epidemiology of Viral Hepatitis from 2007 to 2016 in Karbala Governorate, Iraq. Karbala J Med. 2016; 9(2): 2498-504.

36. National Development Plan (NDP). Republic of Iraq- Ministry of Planning. Baghdad: 2013.

37. Rafeey M, Shoaran M. Prevalence and risk factors of hepatitis a in children in Tabriz, Iran. J Anal Res Clin Med. 2014; 2(4): 183-6.