

Seroprevalence of anti-hepatitis A virus antibody in Iraq

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Abstract

Background: Hepatitis A virus infection is widespread in Iraq, therefore, assessing its seroprevalence is important for infection control at the community level.

Aims: To determine hepatitis A virus seroprevalence in a representative sample in Duhok Governorate, northern Iraq; evaluate changes in the epidemiological pattern; and assess factors associated with its seropositivity.

Methods: This cross-sectional study was conducted from July 2020 to November 2021. Random cluster sampling was used to select participants aged 5–74 years. Hepatitis A virus immunoglobulin G (IgG) was determined among the participants and demographic data were collected on sex, residency (urban or rural), age, history of jaundice, number of family members (\leq five or $>$ five), and sources of drinking water.

Results: A total of 1052 participants (625 males and 427 females) were enrolled. The overall seroprevalence of hepatitis A virus IgG was 68.3%: 24.4% in ages 5–10 years; 38.3% in ages 11–15; 86.9% in ages 16–20; 85.4% in ages 21–30; 95.3% in ages 31–40; and 89.2% in ages $>$ 40 years. Factors significantly associated with hepatitis A virus IgG positivity were rural residence, male sex and family size greater than five (all $P < 0.01$).

Conclusion: Hepatitis A virus seroprevalence in Iraq has been declining since the past decade, 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, immunoglobulin G, prevalence, seroepidemiological studies, Iraq.

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Introduction

Hepatitis A virus (HAV), transmitted by the faecal–oral route, is one of the main causes of acute viral hepatitis globally (1). Epidemiologically, the distribution of HAV infection varies geographically, correlating with the sanitary and hygienic conditions and other indicators of socioeconomic development (2,3). The clinical expression of the HAV infection is age-dependent and is least expressed in children (1). Children play an important part in the transmission of HAV. The seroprevalence of anti-HAV antibody by age group can be used as a marker for the epidemiological patterns of the HAV and viral transmission through the community (3,4). A decline in the seroprevalence of HAV antibodies in a population, especially in the children, indicates a reduced incidence of HAV infection (1,3). Seroepidemiological results have shown that transition to lower infection rates has occurred in several of the hyperendemic countries (1,5). In this case, the clinical manifestations of HAV will possibly be more serious in those countries.

The WHO recommends two methods for determining HAV seroprevalence. Both methods are based on the detection of the anti-HAV IgG antibodies for the determination of HAV endemicity in countries whose populations are mostly unvaccinated against HAV. The first method depends on determination of the prevalence

of HAV in the whole population; the second method uses an age-specific approach (6). For the first method, HAV endemicity is categorized as: high where the prevalence is greater than 50% in the population; intermediate where the prevalence is 15–50%; and low where the prevalence is less than 15% in the population (6,7). The second method categorizes the endemicity into: high (90% by 10 years of age); intermediate (50% by 15 years of age, with $<$ 90% by 10 years of age); low (50% by 30 years of age, with $<$ 50% by 15 years of age); and very low ($<$ 50% by 30 years of age). The age-specific method is considered more accurate and provides a more precise seroprevalence estimation (8).

HAV infection can be prevented through immunization and HAV vaccination can be used for prophylaxis pre- and post-exposure to the virus. Feasibility and cost are the two main barriers to implementation of a HAV vaccine programme. Preventive strategies are dependent on the epidemiological characteristics of HAV infection in any country as with other vaccine-preventable illnesses (9,10).

In Iraq, age-specific and periodic seroprevalence data countrywide are lacking, and the precise epidemiological features of HAV infection are not known. According to WHO, Iraq is hyperendemic for hepatitis A (96.4%) and the number of people infected with hepatitis A has increased. Many factors, such as inadequate hygiene, contaminated

drinking water and tainted food, contribute to the spread of HAV and hepatitis E virus (11,12).

We assessed the age-specific seroprevalence of HAV in individuals aged 5–74 years in Duhok Governorate, northern Iraq and determined the epidemiological characteristics of HAV infection and the most appropriate preventive strategies.

Methods

This was a cross-sectional seroepidemiological study in Duhok Governorate, conducted from July 2020 to November 2021.

The target population was healthy individuals aged 5–74 years in Duhok. We used random cluster sampling to select participants from different areas of Duhok Province including blood banks, hospitals and premarital consultation department of the Directorate of Preventive Health Affairs. Based on an HAV prevalence of 0.2%, with a precision of 0.025 and 95% confidence intervals, the sample size was calculated to be 1052 individuals. Participants with self-reported co-morbidities were excluded from the study.

The epidemiological data were collected using a questionnaire 5 for anti-HAV antibodies at the central public health laboratory in Duhok (immunoglobulin G [IgG]) using an enzyme-linked immunosorbent assay (ELISA), following the recommendations of the manufacturer (HAV-IgG, DIA, ProDiagnostic, Milan, Italy). Results were reported as either negative or positive for HAV IgG.

Statistical analysis

SPSS version 28 was used for the statistical analyses. We used the chi-square test to compare HAV seropositivity by sociodemographic characteristics with $P < 0.05$ considered statistically significant. We calculated the odds ratio (OR) and 95% confidence interval (CI) to estimate the risk factors associated HAV seropositivity.

Ethical considerations

Ethical approval to conduct the study was obtained from the Directorate-General of Health, Duhok Research Ethics Committee (no. 20072020-3). Written consent was obtained from all participants while children's consents were taken from the parents.

Results

A total of 1052 participants (625 males and 427 females) aged 5–74 years were enrolled in this study. The mean (standard deviation) age of the participants was 21.65 (11.89) years.

The characteristics of the participants (age, sex, residence and family size) by HAV positivity are shown in Table 1. All the participants had the same source of drinking-water. In the urban and rural areas, most households had an enclosed system of defecation, but with no centralized system of wastewater and sewage disposal. The overall seroprevalence of the anti-HAV antibodies was 68.3%. Urban residents were significantly less likely to be seropositive for HAV than rural residents (OR = 0.67; 95% CI: 0.51–0.89). HAV seroprevalence was 63.7% in females and 71.5% in males; males were significantly more likely to be seropositive for HAV (OR = 1.43; 95% CI: 1.10–1.86). Seroprevalence was 72.4% where family size was more than five members compared with 60.6% where family size was fewer than five members; participants in larger families were significantly more likely to be seropositive for HAV (OR = 1.70, CI: 1.30–2.23). All participants were drinking tap water and none had a history of jaundice.

Table 2 shows that seroprevalence of HAV positivity increased with the age: from 24.3% in the age group 5–10 years to a high of 95.3% in the age group 31–40 years ($P < 0.001$).

Discussion

A main finding of our study is the demonstration of the epidemiological shift in the HAV seroprevalence

Table 1 Seroprevalence of hepatitis A virus by sociodemographic characteristics of the participants

Characteristic	Total no.	Positive for hepatitis A virus, no. (%)	P-value	OR (95% CI)
Sex			0.009	
Male	625	447 (71.5)		1.43 (1.10–1.86)
Female	427	272 (63.7)		Ref
Residence			0.005	
Urban	702	460 (65.5)		0.67 (0.51–0.89)
Rural	350	259 (74.0)		Ref
Family size, no. of members			< 0.001	
> 5	689	499 (72.4)		1.70 (1.30–2.23)
≤ 5 (not crowded)	363	220 (60.6)		Ref
Total	1052	719 (68.3)	NA	NA

NA: not applicable.

throughout a decade. HAV seroprevalence was 68.3% compared with 96.4% reported in 2011 (12). Our results show an intermediate-to-low endemicity of HAV in Iraq; which is different from the earlier report of a high endemicity of HAV, with a seroprevalence of 96.4% (12). This difference could be because 15 years ago Iraq was facing internal problems and poor socioeconomic status which could have resulted in a higher prevalence of HAV infection. However, with improved access to safe drinking-water and improved socioeconomic conditions in the following years, HAV seroprevalence decreased and a greater number of susceptible people have been protected from HAV infection. Our findings are similar to those of a Jordanian study that found HAV endemicity decreased to an intermediate level over time (13).

A systematic review of Eastern Mediterranean and Middle Eastern countries reported an HAV seroprevalence of 62.6% and 61.6%, respectively (14). Cyprus had reported the lowest HAV prevalence rate (2.6%) and Kuwait and the United Arab Emirates reported a prevalence of less than 50.0%. The highest HAV seroprevalence rates were in Afghanistan (99.0%), Somalia (96.0%) and Palestine (93.7%) (14).

Our IgG seropositivity assessment by age groups showed that IgG seropositivity was highest in the age group 31–40 years, followed by the age group of > 40 years. The most susceptible age group was children aged 5–10 years with only a 24.3% HAV positivity rate. This finding is in agreement with findings from a study in Turkey which reported a prevalence of anti-HAV IgG in children of 29.5% (15). In addition, a Jordanian study reported differing seroprevalence rates by age: 26% in children < 2 years, 32% in children 2–4 years, 44% in children 5–9 years, 63% in children 10–14 years, 78% in adolescents 15–19 years and 94% in those > 20 years (16). This low seropositivity in children younger than 16 years in our study suggests a reduction in faeco–oral transmission of HAV in Iraqi children, reflecting the possible impact of the enhancements in sanitary conditions, stability of the security situation and access to clean drinking-water in Duhok in the past decade. According to WHO, acute HAV

infections are more common in children in the developing countries and in older age groups in developed ones (17). However, our results and those of other studies indicate that HAV infection in developing countries occurs in many different age groups, in childhood as well as in older ages (18).

In general, the rate of HAV seropositivity does not differ by sex (19–21), but higher HAV seropositivity in males has been reported (22). We found that the likelihood of HAV seropositivity was significantly higher in males ($P < 0.05$). In contrast, a study in Turkey in the general population reported an HAV positivity rate of 73.0% in females and 69.3% in males (23). A study in Lisbon, Portugal reported that the prevalence of HAV IgG was 44.4% in females and 53.6% in males, but the difference was not significant (24). 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.

Family contact is considered as a risk factor for the spread of HAV infection. We found HAV positivity was significantly higher where there were more than five family members, which concurs with a Turkish study (25).

Vaccination is suggested for areas with a medium endemicity, according to the United States Centers for Disease Control and Prevention (26). Although scientific evidence suggests that two doses of the inactive hepatitis A vaccine may provide life-long protection (27), this vaccine has not been included in Iraq's schedule of immunization because of a lack of data on the epidemiological pattern of HAV infection in different cities.

In conclusion, the decline in HAV endemicity in Duhok may result in increased vulnerability to symptomatic illness and outbreaks. Therefore, including the HAV vaccination in the national immunization programme and assessment of its benefits to public health are recommended. At the same time, efforts to improve socioeconomic conditions and access to safe drinking-water should continue, particularly in rural areas.

Table 2 Distribution of hepatitis A virus IgG by age group

Age group, years	Total	IgG		% positive
		Positive	Negative	
5–10	238	58	180	24.3
11–15	120	46	74	38.3
16–20	176	153	23	86.9
21–30	274	234	40	85.4
31–40	170	162	8	95.3
> 40	74	66	8	89.2
Total	1052	719	333	68.3

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Competing interests: None declared.

Séroprévalence des anticorps anti-virus de l'hépatite A en Iraq

Résumé

Contexte : L'infection par le virus de l'hépatite A est répandue en Iraq et l'évaluation de sa séroprévalence est donc importante dans le cadre de la lutte anti-infectieuse au niveau communautaire.

Objectifs : Déterminer la séroprévalence du virus de l'hépatite A dans un échantillon représentatif du gouvernorat de Duhok, au nord de l'Iraq; analyser les modifications du tableau épidémiologique et évaluer les facteurs associés à la séropositivité de ce virus.

Méthodes : La présente étude transversale a été conduite de juillet 2020 à novembre 2021. Un sondage aléatoire par grappe a été utilisé pour sélectionner les participants âgés de 5 à 74 ans. L'immunoglobuline G (IgG) du virus de l'hépatite A a été déterminée parmi les participants et des données démographiques ont été recueillies sur le sexe, le lieu de résidence (urbain ou rural), l'âge, les antécédents d'ictère, le nombre des membres de famille (inférieur ou égal à cinq ou supérieur à cinq) et les sources d'eau potable.

Résultats : Au total, 1052 participants (625 hommes et 427 femmes) ont été recrutés. La séroprévalence globale de l'IgG du virus de l'hépatite A était de 68,3% : 24,4% chez les 5-10 ans; 38,3% chez les 11-15 ans; 86,9% chez les 16-20 ans; 85,4% chez les 21-30 ans; 95,3% chez les 31-40 ans; et 89,2% chez les plus de 40 ans. Les facteurs significativement associés à la positivité aux IgG du virus de l'hépatite A étaient la résidence en milieu rural, le sexe masculin et le fait d'avoir une famille de plus de cinq personnes (ensemble des $p < 0,01$).

Conclusion : La séroprévalence du virus de l'hépatite A en Iraq a diminué depuis ces 10 dernières années, ce qui indique une endémicité intermédiaire à faible du virus de l'hépatite A. Toutefois, de nombreuses personnes sont encore à risque, d'où la nécessité d'une vaccination contre le virus de l'hépatite A dans le pays.

الانتشار المصلي للأجسام المضادة لفيروس التهاب الكبد A في العراق

إبراهيم عبد الله، عامر كوريال

الخلاصة

الخلفية: ان العدوى بفيروس التهاب الكبد A منتشرة انتشاراً كبيراً في العراق، ولذلك فإن تقييم الانتشار المصلي لهذا الفيروس أمر مهم لمكافحة العدوى على مستوى المجتمعات المحلية.

الأهداف: هدفت هذه الدراسة الى تحديد الانتشار المصلي لفيروس التهاب الكبد A في عينة ممثلة في محافظة دهوك بشالي العراق، وتقييم التغيرات في النمط الوبائي، وتقييم العوامل المرتبطة بالإيجابية المصلية.

طرق البحث: أُجريت هذه الدراسة المقطعية في الفترة من يوليو / تموز 2020 حتى نوفمبر / تشرين الثاني 2021، واستُخدم أسلوب العينة العنقودية العشوائية لاختيار المشاركين ممن تتراوح أعمارهم بين 5 أعوام و 74 عاماً. وقد حُدِّت حالة المشاركين بالنظر إلى الأجسام المضادة من مجموعة الجلوبيولين المناعي IgG الخاصة بفيروس التهاب الكبد A، وُجمعت البيانات السكانية حول الجنس، والمعيشة (في الحضر أو الريف)، والعمر، وتاريخ الإصابة باليرقان، وعدد أفراد الأسرة (لا تزيد عن خمسة أفراد أو أكثر من خمسة أفراد)، ومصادر مياه الشرب.

النتائج: بلغ مجموع المشاركين 1052 مشاركاً (625 من الذكور و 427 من الإناث)، وقد بلغ المعدل العام للانتشار المصلي للأجسام المضادة من مجموعة الجلوبيولين المناعي IgG الخاصة بفيروس التهاب الكبد A 68.3% : 24.4% في الفئة العمرية 5-10 سنوات؛ و 38.3% في الفئة العمرية 11-15 سنة؛ و 86.9% في الفئة العمرية 16-20 سنة؛ و 85.4% في الفئة العمرية 21-30 سنة؛ و 95.3% في الفئة العمرية 31-40 سنة؛ و 89.2% في الفئة العمرية الأكبر من 40 سنة. وكانت العوامل المرتبطة ارتباطاً كبيراً بالنتيجة الإيجابية للأجسام المضادة من مجموعة الجلوبيولين المناعي IgG الخاصة بفيروس التهاب الكبد الوبائي A هي الإقامة في الريف، والذكورة، وزيادة عدد أفراد الأسرة عن خمسة (القيمة الاحتمالية للكل < 0.01).

الاستنتاجات: منذ العقد الماضي والانتشار المصلي لفيروس التهاب الكبد A في انخفاض في العراق، مما يشير إلى أن توطن فيروس التهاب الكبد A يتراوح ما بين المتوسط إلى المنخفض. ومع ذلك، ما يزال الكثيرون عرضة للإصابة، مما يشير إلى الحاجة إلى التطعيم ضد فيروس التهاب الكبد A في البلاد.

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