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Hepatitis A seroprevalence in Erzurum, Turkey

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Abstract

Introduction and objective. Hepatitis A Virus (HAV), reportedly the most common cause of acute viral hepatitis in developing countries, infects millions of people worldwide each year. The aim of the study is to investigate the seropositivity of anti-hepatitis A virus (HAV) IgG and IgM in all age groups in Erzurum, and to determine the effect of various factors such as age, gender, climatic conditions and HAV vaccination (included in 2012 in the National Immunization Schedule on seroprevalence) on the seropositivity.

Materials and method. The serological results of 25,007 individuals referred to Erzurum Public Health Microbiology Laboratory between January 2015 – December 2018 were retrospectively reviewed to test for the presence of anti-HAV IgG and IgM. The patient ages were 0–93 years. Serum samples were analyzed by ELISA. S/CO values of ≥1.00 and >1.21 were considered positive for anti-HAV IgG and IgM, respectively; results below this value were considered negative.

Results. Anti-HAV IgG and IgM seropositivities were 87.3% and 0.2%, respectively. Anti-HAV IgG prevalence – 88.5% and 86.4%, anti-HAV IgM positivity – 0.1% and 0.3% in men and women. Anti-HAV IgG seroprevalence – 87%, 73.2%, 58.7%, 75.2%, 86.1%, 89.8%, 96.1%, 99.1%, 99.1% and 99.3%, respectively, at 0–4, 5–9 10–14, 15–19, 20–24, 25–29, 30–39, 40–49, 50–59 and >60 age groups. Anti-HAV IgM seropositivity – 0, 0.1%, 0.7%, 0.7%, 0.3%, 0, 0.1%, 0.2%, 0.1%, and 0.2%, respectively, in the same age groups. Anti-HAV IgM positivity was the highest in November – 36(0.97%.

Conclusion. In Erzurum, anti-HAV IgG prevalence is tremendously high, whereas prevalence of anti-HAV IgM is exceptionally low, especially in the paediatric age group. Therefore, HAV vaccine is provided free of charge in Turkey, including Erzurum, since 2012.

Key words

Hepatitis A, HAV IgG, HAV IgM, risk factor, prevalence

INTRODUCTION

Acute viral hepatitis A caused by the hepatitis A virus (HAV) is a vaccine-preventable infectious disease that is reported worldwide, most commonly in undeveloped and developing countries [1]. HAV is a non-enveloped, single-stranded, and positive-sense RNA virus that belongs to the Hepatovirus genus of the Picornaviridae family [2]. It was reported that approximately 1.5 million people are infected with HAV each year globally [3, 4]. HAV is generally transmitted person-to-person by direct contact through the faecal–oral route or via the consumption of contaminated water or food [5]. The incidence of the disease was found to be closely linked with socio-economic status, hygiene conditions and access to safe water [4, 6]. HAV infection is often asymptomatic during the first years of life but its severity increases with age. In rare cases, HAV infection can cause liver failure and death; mortality reaches upto approximately 2% in older adults [3, 7]. Anti-HAV antibody immunoglobulin (Ig) M in the serum must be identified to establish a diagnosis of acute HAV, which has sensitivity and specificity of over 99% [5, 8]. Anti-HAV IgG antibodies can detect previous infections and may be present for several years following infection or vaccination [9, 10].

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OBJECTIVES

The aim of this study was to determine the seropositivity of anti-HAV IgG and IgM in all age groups in Erzurum, Turkey, and to investigate the effect of various factors such as age, groups, gender, season and HAV vaccination that was included in the National Immunization Schedule in 2012 on seroprevalence.

MATERIALS AND METHOD

The serological results of 25,007 individuals referred to Public Health Microbiology Laboratory (Erzurum, Turkey) between January 2015 – December 2018 to be tested for the presence of anti-HAV IgG and IgM were retrospectively reviewed.

Blood samples were analysed immecdiately by ELISA using Architect i2000SR anti-HAV IgG and IgM assays (Abbott Diagnostics, Germany). S/CO values of ≥1.00 were considered to be positive for anti-HAV IgG and S/CO values of >1.21 were considered to be positive for anti-HAV IgM. Results below this value were considered to be negative, as recommended by the manufacturing company.

Statistical analysis. SPSS Statistics V22 was used for all statistical analysis. Continuous data were summarised as standard deviation and mean, whereas categorical data were summarised as number and percentage. Statistical evaluation was performed using Pearson chi-square (χ^2) test to detect anti-HAV IgG and IgM positivity differences, according to gender, age groups and months. A p value of ≤0.05 was

evaluated as statistically significant. Patients with no data on anti-HAV IgM and IgG tests were considered as lost data and excluded from the analysis. The study was approved by the Ethics committee of Clinical Research Board at Ataturk University (Decree No. 3, dated 30 May, 2019). Permission was also granted by the Erzurum Provincial Health Directorate on 20 December 2019 to access and use patient data.

RESULTS

The study comprised a total of 25,007 individuals aged between 0 – 93 years; of these, 14,089 were women (56.3%) and 10,918 were men (43.7%). The mean (standard deviation) age of the patients was 28.6±13.Seropositivity ratio of Anti-HAV IgG – 87.3% (21,842/25,007), seropositivity ratio of anti-HAV IgM – 0.2% (49/25,007). Furthermore, the positivity ratio of anti-HAV IgG was 88.5% in men and 86.4% in women; this was statistically significant. The positivity ratio of anti-HAV IgM in men to women was 0.1% – 0.3% (Tab. 1).

Anti-HAV IgG seroprevalence was 87%, 73.2%, 58.7%, 75.2%, 86.1%, 89.8%, 96.1%, 99.1%, 99.1% and 99.3% in the following age groups: 0–4, 5–9, 10–14,15–19, 20–24, 25–29, 30–39, 40–49, 50–59 and >60 years, respectively. The difference between the groups was statistically significant ($p< 0.05$). While the lowest ratio of Anti-HAV IgG seropositivity was detected at the 10–14 age group, the highest ratio of Anti-HAV IgG seropositivity was recorded in the >40 age groups. There was no statistical difference among age groups: 40–49, 50–59 and >60 (Fig. 1). On the other hand, anti-HAV IgM seropositivity was 0%, 0.1%, 0.7%, 0.7%, 0.3%, 0, 0.1%, 0.2%, 0.1% and 0.2%, respectively, in the same age groups; intergroup differences were also significant (Fig. 1). The highest ratio of Anti-HAV IgM seropositivity was determined in the age groups 10–14 and 15–19 (Fig. 1). The highest positivity of Anti-HAV IgM occurred in November – 36 (0.97%); intergroup differences were statistically significant – $p<0.001$ (Fig. 2).

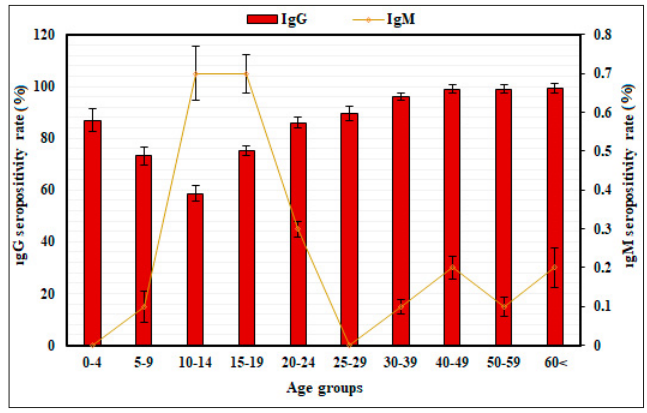

Figure 1. Anti-HAV IgG and IgM prevalence by age groups

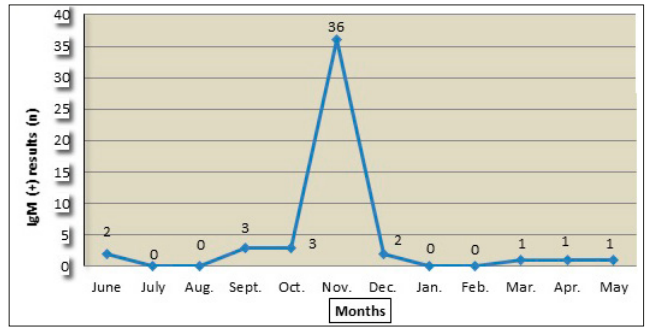

Figure 2. Distribution of hepatitis A virus IgM-positive patients by month

DISCUSSION

Hepatitis A is the most common type of viral hepatitis [11]. Today, the incidence of HAV infection is been decreasing and the age of contact with the virus has been shifting to the older age group in which a person becomes susceptible to the viral infection as a result of improvement in hygiene and sanitation conditions. Although HAV has a low mortality,

Table 1. Distribution of the serology results of anti-HAV IgG and IgM by gender and age groups

Particulars	No. of cases n (%)	HAV IgG(+) n (%)	P value	Sample Size n (%)	HAV IgM(+) n (%)	P value
Gender						
Female	14,089 (56.3)	12,179 (86.4)	<0.001	14,052 (56.3)	37 (0.3)	<0.001
Male	10,918 (43.7)	9,663 (88.5)		10,918 (43.7)	12 (0.1)	
Total	**25,007 (100)**	**21,842 (87.3)**		**25,007 (100)**	**49 (0.2)**	
Age Groups						
0–4	123 (4.3)	107 (87)	<0.001	123 (0.5)	0 (0.0)	<0.001
5–9	1,083 (24.5)	793 (73.2)		1,083 (4.3)	1 (0.1)	
10–14	1,835 (7.3)	1,078 (58.7)		1,835 (7.3)	12 (0.7)	
15–19	2,843 (8.5)	2,138 (75.2)		2,843 (11.4)	19 (0.7)	
20–24	4,733 (16.3)	4,074 (86.1)		4,733 (18.9)	4 (0.3)	
25–29	4,917 (19.7)	4,416 (89.8)		4,917 (19.7)	2 (0.0)	
30–39	5,041 (20.2)	4,842 (96.1)		5,041 (20.2)	4 (0.1)	
40–49	2,306 (9.2)	2,285 (99.1)		2,306 (9.2)	4 (0.2)	
50–59	1,239 (5.0)	1,228 (99.1)		1,239 (5.0)	1 (0.1)	
>60	887 (3.5)	881 (99.3)		2,33 (3.5)	2 (0.2)	
Total	**25,007 (100)**	**21,842 (87.3)**		**5,058 (100)**	**49 (0.2)**	

it is considered as a public health problem that needs to be addressed because it leads to outbreaks resulting in loss of labour [12]. The incidence of HAV infection suggests that there are three patterns of endemicity in the world: high, medium and low. High endemicity (90% of the population is seropositive by the age of 10 years) is observed in countries with poor sanitary conditions, whereas low endemicity (50% of the population is seropositive by the age of 30 years) is observed in countries with good hygiene and sanitary conditions. Furthermore, moderate endemicity (90% of the population is seropositive by the age of 15 years) occurs in the countries with moderate socio-economic conditions [13]. Turkey falls within the moderate endemicity category in terms of HAV seroprevalence, with a wide range of seroprevalence due to the socio-economic difference in its various regions [14].

A study by Ceyhan *et al.* [15] comprised of five different geographical regions of Turkey reported that HAV IgG prevalence is 64.4% whereas in the presented study anti-HAV seroprevalence was found to be 84.4%. The results were above the average in Turkey. Studies on the prevalence of HAV in Turkey and different regions around the world are presented in Table 2. Since the level of development of eastern part of Turkey is lower than in the western part of the country, the seropositivity rate was higher in the eastern part than that in the western part. The low prevalence rates of hepatitis A in developed countries can be explained by the absence of infrastructure-related problems, established water sanitation and high hygiene awareness [16].

The presented study found IgG prevalence to be 87%,73.2%, 58.7%, 75.2% and 86.1% in the investigated age groups – 0–4, 5–9, 10–14, 15–19 and 20–24, respectively. Compared with the study by Vancelik et al. [17] conducted 12 years ago in Erzurum, this rate has increased since then. However, with improvements in the sanitation infrastructure and better access to hygienic water, the prevalence rates in the paediatric age group were expected to decrease during this 12-year period. This suggested an association with the effect of hepatitis A vaccination administered in two doses in Turkey in 2012. This view is further supported by the IgG prevalence being the lowest in the age group 10–14 years which is not covered by the HAV immunisation schedule by the Ministry. Some studies have shown that two doses of HAV vaccine administered to children would lead to a significant decrease in acute HAV incidence in all age groups [24]. In addition, the HAV immunity rate, which increases with increasing age, leads to a decrease in anti-HAV IgM positivity rates in older age groups.

In a study carried out in Konya, Turkey, Kalem et al. [28] found that anti-HAV IgM seropositivity was 2.9% and anti-HAV IgM seropositivity was 18.1%. A study by Parlak et al. [11] in Van, Turkey, determined that the anti-HAV IgM seropositivity was 9.8% in the paediatric age group. In a study conducted in Korea by Lee et al. [25], IgM positivity was found to be 11.0%, whereas in a study by García-Juárez et al. [29] conducted in Mexico, anti-HAV IgM positivity was 13%. In this study, the anti-HAV IgM seropositivity was 0.2%. Moreover, the present study, the anti-HAV IgM results were very low in compared to those of the other studies. This is believed to be associated with the hepatitis A vaccination administered in two doses, free of charge in Turkey since 2012, in the age groups of 18–24 [30]. This view is supported by zero IgM seropositivity and anti-HAV IgG prevalence of 87% in the age group of 0–4 years.

There are many studies on the effect of gender differences on hepatitis A seroprevalence. Kanra *et al.* [31] found in their study conducted in general population in Turkey the total HAV positivity rate to be 73% in women and 69.3% in men. The high rate observed in men in the adult group was statistically significant – $p<0.05$. Cortes-Martins et al. [32] reported in their study conducted in Lisbon that the prevalence of HAV IgG was 44.4% in women and 53.6% in men, and no significant difference was observed between the two genders. In the study by Vilibic-Cavlek et al. [33] conducted in Croatia, this rate was 39.6% in women and 44% in men, but they reported no significant differences in terms of gender. In the presented study, HAV IgG seropositivity was significantly higher in boys than in girls. The high rate observed in boys is believed to be mainly associated with them being more in contact with the external environment, and consuming more unhygienic foods and beverages.

HAV seasonal peaks are observed in the autumn and winter months in some temperate countries. For instance, it has been reported that Germany reached the highest level of HAV infections in autumn [34], and during this period Turkey has also reported an increase in HAV infections [16]. A study that evaluated anti-HAV IgM levels according to seasons in the Eastern Anatolia Region of Turkey, revealed that the seropositivity rate showed seasonal changes that were higher in periods of increased regional rainfall [11]. In

Table 2. Studies on seroprevalence of HAV IgG in different age groups in Turkey and worldwide

Study [Ref.]	Country/Province	Years	Sample size	Age group (years) – seropositivity rate (%)
Vançelik [17]	Turkey/Erzurum	2006	392	<1: 77%; 1–4: 66%; 5–9: 77%; 10–14: 93%; 15–19: 90%; 20–24: 88%; 25–29: 88%
Alhan [18]	Turkey/Adana	2014	771	2–3: 10%; 4–5: 22%; 6–7: 25%; 8–9: 31%; 10–11: 35%; 12–13: 38%; 14–15: 47%
Ceran [19]	Turkey/Istanbul	2012	630	5–9: 11%; 10–14; 29%; 15–19: 50%; 20–24: 69%
Dede [20]	Turkey/Ankara	2013	1443	1–4: 14%; 5–9: 33%;10–14: 31%; 15–19: 23%; 20–24: 46%; 25–34: 78%; >35: 100%
Bawazir [21]	Yemen	2005	538	0–5: 62%; 6–9: 90%; 10–14: 98%; 15–44: 100%; 45–79: 98%
Hayajneh [22]	Jordan	2008	3066	0–1: 26%; 2–4: 32%; 5–9: 44%; 10–14: 63%; 15–19: 78%; ≥20: 94%
Turkey [23]	Iraq	2006	9610	1–10: 91%; 11–20: 97%; 21–30: 98%; 31–40: 97%; ≥41: 98%
Melhem [2]	Lebanon/Beirut	2015	283	19–29: 48.4%; 30–39: 26.5%; 40–49: 16.9%; 50–59: 8%
Hoseini [24]	Iran	2015	2494	10: 15%; 11: 38%; 12: 57%; 13: 3%; 14: 71%; 15: 71%; 16: 71%; 17: 71%; 18: 78%
Anna Lee [25]	Korea/Seoul	2009	11068	1–10: 9.1%; 11–20: 9.8%; 21–30: 18.5%; 31–40: 23.2%; ≥41: 39.4%
Domínguez [26]	Spain	2007	1292	15–24: 15.4%; 25–34: 34.9%; 35–44: 75.1%; 45–54: 93.8%; 55–64: 97.3%; >64: 98.2%
Moisseeva [27]	Ukraine	2007	1380	1–5: 9.2%; 6–11: 9.7%; 12–17: 16.1%; 18–50: 42.1%; >50: 81.7%

the presented study, the highest HAV IgM seropositivity rate was measured during autumn (November). It is thought that this high rate is due to the increase in precipitation during this period, and contamination of drinking and utility waters in the region.

CONCLUSIONS

In Erzurum, Turkey, the prevalence of anti-HAV IgG is immensely high while the prevalence of anti-HAV IgM is decidedly low, especially in the paediatric age group. This is largely the result of the HAV vaccine which has been administered free of charge throughout Turkey, including Erzurum, since 2012. Sero-epidemiological information is valuable in the prevention of outbreaks, establishment of protection policies, and plan-effective vaccination programmes. Because the presented study covers a large population, it can be used as a guide for the serological status of the city of Erzurum in terms of hepatitis A. Precautions should be taken against epidemic diseases with the onset of precipitation, and the public should be informed about the safety of drinking water during these months.

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