Contents lists available at ScienceDirect

Asian Pacific Journal of Tropical Medicine

journal homepage:www.elsevier.com/locate/apjtm

Document heading

Seroprevalence of hepatitis A antibodies among children in a Saudi community

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ARTICLE INFO

Article history:
Received 2 February 2010
Received in revised form 12 March 2010
Accepted 20 March 2010
Available online 20 April 2010

Keywords:
Hepatitis A
Seroprevalence
Risk factors

ABSTRACT

Objective: To determine the current seroprevalence of antibodies against hepatitis A virus in selected group of children aged 1-6 years in Northern borders region, Saudi Arabia, and to identify risk factors for infection. **Methods:** A cross-sectional sero-epidemiological study of 950 children who attended 10 randomly selected primary health care centers (5 urban and 5 rural) was done. Parents of all children were subjected to a questionnaire including sociodemographic and housing environmental data. The determination of anti-HAV antibodies was carried out by ELISA-test. **Results:** The prevalence of HAV-IgG was 33.8% overall, 35.5% among males and 32.0% among females with no statistically significant difference. Multivariate logistic regression analysis revealed that increasing age, rural residence, non Saudi nationality, and non availability of safe municipal water source were the most important independent predictors for HAV seropositivity in the studied children. **Conclusions:** There is a clear decrease in hepatitis A prevalence in the studied children particularly in urban areas and indicates that a transition may be underway to intermediate endemicity and possible shift of the risk to the adult age with increased morbidity. So, we recommend including Hepatitis A in the schedule of routine childhood vaccinations.

1. Introduction

Hepatitis A virus (HAV) is endemic in many developing countries, somewhere the prevalence can be as high as 100% in children less than 5 years old[1]. Three epidemiologic patterns of endemicity (low, intermediate, and high), seen worldwide, reflecting the level of economic development[2]. The prevalence of HAV is very closely related to the socioeconomic status of the population and may vary within the same country according to changes in hygienic conditions[3,4]. In developing countries, low economic status, high crowding, and inadequate water treatment contribute to a high endemicity pattern[5]. The epidemiologic pattern of hepatitis A infection is currently changing in many developing countries with improvements in socioeconomic conditions, public health programs and sanitary conditions[6]. It is important to detect such shifts because disease severity increases with older age, and adults are thus more likely to experience morbidity when infected, leading to greater disease burden and significant health problems[3,7].

Highly effective vaccines against hepatitis A have been available since the mid 1990s, and have proven to reduce disease burden and offer protection to at-risk populations[8]. However, vaccination is expensive and there are numerous reports worldwide on the changing epidemiology of hepatitis A and its prevalence. Therefore, information on the prevalence of immunity in each population would be required for any national hepatitis vaccination programme[9].

Earlier surveys in Saudi Arabia indicated that HAV is endemic in Saudi Arabia, with approximately 90% of the adult population having positive anti-HAV[10-12].

Improvement of socioeconomic conditions in this country may lead to changes in the epidemiology of HAV infection, with a decrease in antibody prevalence among children; consequently a significant proportion of the adolescent and adult population will be at risk of infection.

The study aimed to determine the current seroprevalence

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of antibodies against hepatitis A virus in selected group of children aged 1-6 years living in Northern borders region, Saudi Arabia, and to identify associated risk factors.

2. Materials and methods

This is a cross-sectional, sero-epidemiologic investigation of HAV among 1-6 years old children in the province of Northern borders, Saudi Arabia. The study was accomplished during February 2006 and January 2007.

According to the statistics of health directorate of Northern borders province, the number of children aged 1-6 years was estimated to be about 32 000. Primary health care is provided through a network of 40 primary health care centers (PHCC). Ten (PHCC) were selected (5 urban and 5 rural) randomly. From each selected PHC, one physician and one nurse (Arabic speaking) were assigned, trained and supervised by the author throughout the study. Pilot study on 100 children from different social classes (10 from each of the 10 PHCC) was conducted to determine the seroprevalence of anti-HAV IgG antibodies. The minimum sample size for the study (n= 941) was calculated using Epi-Info 2004 software and considering power=80%, 95% confidence level. The sample size was distributed proportionally between selected urban and rural PHCC. Children were enrolled in the study from those attending for vaccination or regular check-up at the selected PHCC after the verbal informed consent was obtained from parents or guardians. Children who attended more than once during the study period were included only once. Parents/guardians of children were interviewed by a questionnaire included socio-demographic data (child age and sex, residence, nationality, educational level and occupation of parents, number of family members, monthly family income socioeconomic status, *etc*.), home sanitary conditions (source of drinking water, refuse disposal, sewage disposal, *etc*.) and previous history of symptomatic hepatitis A or hepatitis A vaccination or blood transfusion. Enrolled children were medically examined and checked for predefined inclusion/exclusion criteria. The exclusion criteria were chronic illness, previous history of jaundice, previous vaccination against hepatitis A or blood transfusion. Socioeconomic status (SES) was determined according to the scale of Fahmy and El-Sherbiny[13]; Items including mother's educations, father's education, family income, family size, water supply, refuse disposal and sewage disposal were assessed to categorize SES of the children into very low, low, middle and high. Five mL venous blood was collected from each child. The sera were separated by centrifugation, coded and kept frozen in micro tubes in -20 ℃ temperature to be examined simultaneously later in the same laboratory in Arar Central Hospital laboratory. IgG Antibodies to hepatitis A virus (anti-HAV) was detected using the ELISA kits from Abbott Laboratory (Chicago, Illinois). The study was approved by the Northern Region General directorate of health affairs.

Data were analyzed using SPSS version 16 software (SPSS, Inc., Chicago, IL). A descriptive analysis was followed by bivariate analysis using a *Chi*-square test for comparison of the various sub-groups with a 5% statistical significance level. A multivariate logistic regression analysis was used to determine independent predictors of seroprevalence. Odds ratios and 95% confidence intervals were calculated and presented for these variables.

3. Results

A total of 950 (1-6 years old) children were enrolled in the study (490 males and 460 females). The prevalence of IgG antibodies to HAV was 33.8% overall, 35.5% among males and 32.0% among females with no statistically significant difference (P=0.247). However, it increased significantly with the age. The IgG antibodies to HAV were found in 57.5% of rural children, and 27.5% of urban (P<0.001). A higher proportion of non-Saudi children were found anti-HAV seropositive than Saudi children (43.1% & 32.7%, respectively) (P=0.035). (Table1).

Table 2 showed that higher educational levels of parents were significantly associated with lower HAV seropositivity among studied children (P= 0.001). Children of non employed mothers were more likely to have past infection with HAV than those of employed (OR=1.41). Moreover, father's occupation had a significant influence on HAV seroprevalence, the lowest seropositivity (30.0%) was found among children whose fathers were working, professional/semiprofessional, while the highest seroprevalence was among those whose fathers were workers (40.7%). Low socioeconomic children were more likely to have past infection with HAV than those categorized as being in the high and middle socioeconomic levels. Low family income and crowding index were significantly associated with high HAV seropositivity (P=0.013, 0.02, respectively). A higher prevalence of anti-HAV was found among children living in houses with nonhygienic water supply, and unhygienic refuse disposal (55.8%, and 65.6% respectively) compared to others with a safe municipal water supply , and hygienic refuse disposal (18.2%, and 27.8% respectively) (both P < 0.001). With regard to family size and availability of sewage facilities with flushing system, they had no significant influence on HAV seroprevalence. From multivariate logistic regression analysis, increasing age, rural residence, non Saudi nationality, and non availability of safe municipal water source were the most important independent predictors for HAV seropositivity among the studied children (Table 3).

4. Discussion

This study showed that about 33.8% of 1-6 years old children in Northern borders region, Saudi Arabia had previous contact with hepatitis A virus. This finding is lower than that reported in national study conducted in Saudi Arabia during 1989-1990, where the seroprevalence was 52.4% overall and highest (67%) in neighboring northwestern region[14]. This indicates a shift of HAV epidemiological pattern in Saudi Arabia from high to

Table 1

Seroprevalence of anti-hepatitis A virus (HAV) IgG antibodies among studied children in relation to demographic variables.

Group		Total (*n*, %)	Anti-HAV IgG seropositive No. (%)	*P* value	*OR* (95% *CI*)
	Overall	950 (100.0)	321 (33.8)		(30.90-36.90)
Age (years)	1- < 3	265 (27.9)	50 (18.9)		1[a]
	3- < 5	295 (31.1)	99 (33.6)	< 0.001	2.17 (1.44-3.27)
	5- < 7	390 (41.1)	172 (44.1)	< 0.001	3.39 (2.31-4.98)
Sex	Female	460 (48.4)	147 (32.0)		1[a]
	Male	490 (51.6)	174 (35.5)	0.247	1.17 (0.89-1.55)
Residence	Urban	750 (78.9)	206 (27.5)		1[a]
	Rural	200 (21.1)	115 (57.5)	< 0.001	3.57 (2.55- 5.00)
Nationality	Saudi	848 (89.3)	277 (32.7)		1[a]
	Non Saudi	102 (10.7)	44 (43.1)	0.035	1.56 (1.03-2.37)

1[a] = reference group.

Table 2

Seroprevalence of anti-hepatitis A virus (HAV) IgG antibodies among studied children in relation to socioeconomic and environmental variables.

Group		Total (*n*, %)	Anti-HAV IgG seropositive No (%)	*P* value	*OR* (95% *CI*)
Mother's education	Secondary & above	430 (45.3)	120 (27.9)		1[a]
	< Secondary	520 (54.7)	201 (38.7)	0.001	1.63 (1.24-2.14)
Father's education	secondary & above	455 (47.9)	130 (28.6)		1[a]
	< secondary	495 (52.1)	191 (38.6)	0.001	1.57 (1.19-2.06)
Mother's employment	Employed	290 (30.5)	83 (28.6)		1[a]
	Not employed	660 (69.5)	238 (36.1)	0.026	1.41 (1.03-1.93)
Father's occupation	Professional/ semi- professional	443 (46.6)	133 (30.0)		1[a]
	Business/ trades	232 (24.4)	76 (32.8)	0.443	1.14 (0.80-1.66)
	Skilled/unskilled workers & others	275 (28.9)	112 (40.7)	0.003	1.60 (1.15-2.22)
Family size	< 7	357 (37.6)	113 (31.7)		1[a]
	7 +	593 (62.4)	208 (35.1)	0.280	1.17 (0.88-1.54)
Family income	Satisfactory	423 (44.5)	125 (29.6)		1[a]
	Not satisfactory	527 (55.5)	196 (37.2)	0.013	1.41 (1.06-1.87)
Crowding index	< 2	344 (36.2)	100 (29.1)		1[a]
	2+	606 (63.8)	221 (36.5)	0.020	1.40(1.05-1.86)
Municipal water	Available	556 (58.5)	101 (18.2)		1[a]
	Not avaiable	394 (41.5)	220 (55.8)	< 0.001	5.69 (4.25-7.64)
Refuse disposal	Hygienic	799 (84.1)	222 (27.8)		1[a]
	Not hygienic	151 (15.9)	99 (65.6)	< 0.001	4.95 (3.37-7.29)
Sewege facilities with flush toilet	Available	679 (71.5)	217 (32.0)		1[a]
	Not avialable	271 (28.5)	104 (38.4)	0.060	1.33 (0.99-1.78)
Social score	High	215 (22.6)	44 (20.5)		1[a]
	Middle	519 (54.6)	158 (30.4)	0.005	1.7 (1.14-2.53)
	Low & very low	216 (22.7)	119 (55.1)	< 0.001	4.77 (3.05-7.48)

Table 3
Multivariate logistic regression analysis of significant predictors of HAV seropositivity.

Gruop		β	*P* value	*OR* (95% *CI*)
Age (years)	1-<3	-		1[a]
	3-<5	0.79	<0.001	2.22 (1.44-3.42)
	5-<7	1.39	<0.001	4.05 (2.69-7.05)
Nationality	Saudi	-		1[a]
	Non Saudi	1.46	<0.001	4.29 (2.62-7.98)
Residence	Urban	-		1[a]
	Rural	0.83	<0.001	2.29 (1.57-3.34)
Municipal water	Available	-		1[a]
	Not avaiable	1.87	<0.001	6.48 (4.59-9.16)
	Constant		-2.81	
	Model χ^2		245.06, *P*<0.001	
	Percent correctly classified		75.79	

1[a] = reference group.

intermediate endemicity which coincides with socio-economic development. Also, it is much lower than that reported in Palestine,Lebanon, Egypt and northern India (87.8%, 78.1%, 64.3% and 68% respectively) [15-18].

In the current study the seroprevalence of anti-HAV showed increased trend with increased age, a finding consistent with that reported in previous studies[7,14]. In our study significantly higher HAV seroprevalence was observed among rural children than urban ones and this may be partly explained by the difference in the nature of water supply. While nearly all urban areas are supplied by water pipes from a central reservoir, many villages depend on wells and tankers delivering water supplies[14]. Similar urban-rural differences have been reported previously[14,19].

In the present study, the HAV seroprevalence was significantly higher among children living in poor sanitary conditions and water supply was the most important significant risk factor for prediction of HAV seropositivity. This has been reported previously in other studies [14,17,20].

One of the important significant risk factors for prediction of HAV seropositivity revealed by the present study was nationality. Non Saudi children (mostly from Middle Eastern countries) were more likely to have exposed to HAV past infection than Saudi children. This nationality differences suggest that HAV endemicity is decreasing more rapidly in Saudi Arabia, with its higher percapita income than in other Middle Eastern countries. This is in accordance with that reported previously by Khalil *et al*[21].

In conclusion, the results of this study suggest that HAV epidemiology has changed in Saudi Arabia from a high to an intermediate endemicity pattern. This shift has been a well-known epidemiologic feature in developing countries that underwent socio-economic and hygienic improvements, such as Latin America[22]. Due to this gradual shift from high to intermediate endemicity for hepatitis A, there will be a drop in HAV circulation and consequently the immunity to HAV infection falls rapidly, resulting in a growing pool of susceptible adolescents and adults with high risk of severe hepatitis A with serious public health consequences [23]. The probability of HAV epidemic increases due to the significant number of individuals susceptible to infection. The WHO position paper on hepatitis A vaccines [24] states that in countries of intermediate endemicity, large-scale childhood vaccination should be considered as a supplement to health education and improved sanitation. The shift in epidemiologic pattern observed in Saudi Arabia and the availability of safe and effective hepatitis A vaccines stress the need to consider inclusion of hepatitis A vaccine programs in the national immunization schedule of Saudi Arabia to reduce the risk of hepatitis A morbidity and mortality in susceptible children and adolescents.

This clinic-based study was done in one region of the Kingdom. A community-bases nationwide study is warranted to give a full picture of hepatitis A endemicity.

Conflict of interest statement

We declare that we have no conflict of interest.

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