Seroprevalence and Associated Risk Factors for Hepatitis A Among School-Age Children in Sohag Governorate, Upper Egypt

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Abstract:

Background: Hepatitis A virus (HAV) infection is an important public health problem throughout the world, particularly in children and is endemic in areas with substandard hygiene and sanitation.

The aim of the study: is to determine the seroprevalence of hepatitis A virus (HAV) infection among school-age children and the associated risk factors in Sohag Governorate.

Methodology: In a cross-sectional study, a sample of 1264 children aged 4-18 years, non randomly selected from the pediatric and gastroenterology outpatient clinics, Sohag University hospital. Informed consent was obtained from their guardians. Three tools were used for data collection: Tool I: preconstructed questionnaire sheet containing: 1- Sociodemograhic data of the participant children and their parents, 2- Clinical history and clinical examination, 3- History of sanitary conditions as water supply, refuse and sanitary disposal and history of personal hygienic habits. Tool II: determination of the socio-economic class according to Fahmy and Sherbini scale. Tool III: Blood samples collection for detection of HAV antibodies based on ELISA techniques (Dia Sorin, Italy). Children with chronic hepatic or systemic diseases and those previous vaccination for HAV were excluded.

Results: 57.3% of study children were seropositive for HAV antibodies. There was a statistically significant relation between HAV seropositivity and low socioeconomic status, rural residency, age group 12-18 years, outside house water supply, non-hygienic refuse disposal and non-hygienic sewage disposal ($p<0.05$).

Conclusions: the overall seroprevalence of anti-HAV Ab in our sample was 57.3%. Anti-HAV Ab prevalence was significantly higher with older age, rural residence, lower socio-economic class and unhygienic personal habits and poor sanitary disposal.

Recommendations: Education program for the population about mode of transmission of HAV infection and governmental efforts towards sanitary water supply, hygienic refuse and sewage disposal specially in rural areas. Vaccination against HAV in Egypt should be kept in

mind for children aged 12–18 years but after testing for HAV Ab.

Key words: *Hepatitis A – Seroprevalence – Antibodies – Risk factors.*

Introduction:

Hepatitis A virus (HAV) is an acute self-limited liver infection caused by a picornavirus and transmitted through the fecal-oral route. HAV causes 10 million infections worldwide each year.[1] Infection with hepatitis A occurs worldwide and is the most common cause of acute viral hepatitis. The prevalence of HAV infection closely correlates with the degree of environmental sanitation and the socioeconomic and hygienic conditions.[2]

Areas of high endemicity include Africa, Asia and South of America. Household crowding, poor levels of sanitation and inadequate water supplies are the conditions which contributed to the propagation of the virus among young children in these areas, [1,3] Most people in these areas become infected in early childhood. In this age group, the infection is usually mild, non-specific or asymptomatic and induces anti- HAV antibodies that confer to life-long immunity against reinfection.[4]

In areas of low endemicity (mostly developed countries), the incidence of hepatitis A virus infection among young children is low and the proportion of susceptible individuals, especially young adults, is high.[5] In older children and adults, infection is usually symptomatic.[6]

Sub-Saharan Africa has some of the highest anti-HAV prevalence rates in the world and nearly all older children and adults are naturally immunized. In Liberia in the late 1970s, more than 80% of 4-5 years old had antibodies to HAV. In the same period in Senegal, nearly 100% of children had antibodies to HAV by the age of 5 years and in Nigeria, more than 90% of adults had HAV antibodies.[1] In Tunisia, child infection rates remain high with differences between urban and rural settings. In a larger study performed in three

different regions of Tunisia in 2007, HAV seroprevalence was 84%, 90.5% and 91.7% with a mean age of 6.94, 12.84 and 20.71 years respectively.[7]

In Egypt, a seroprevalence study in 1996 found that 100% of the 155 children tested between 1-3 years of age were positive for HAV.[8] Another study in 2008 found that, 61.4% of the 296 children tested between 2.5 and 18 years of age were positive for HAV. [9]

The expression of clinical symptoms varies greatly with the age of the infected person. Approximately 50% of children with hepatitis A under the age of 6 years are asymptomatic, with most of the remaining having mild symptoms, often not recognized as hepatitis. Less than 5% of children below 4 years of age and less than 10% of children between 4-6 years with hepatitis A develop jaundice. Starting from 6 years of age to adulthood, more than 75% develop the characteristic illness traits with jaundice and dark urine.[3]

Aim of the work: is to determine the seroprevalence of antibodies against hepatitis A virus among sample of children in Sohag Governorate during the year 2014 and to identify some associated risk factors.

Subjects and methods:

Design: this study is a cross-sectional one.

Setting: this study was carried out in the pediatric and gastroenterology outpatient clinics in Sohag University hospital during the 6 month period September 2013 -Marsh 2014. These outpatient clinics serves all districts of Sohag Governorate.

Sample: the present study included 1264 children (males and females), aged 4-18 years. A simple random sampling method was used to select the children attending the pediatric and gastroenterology outpatient clinics.

Ethical considerations: the study was approved by the ethical committee of the Faculty of Medicine, Sohag University. Informed consent was obtained from the

guardians of study children after full explanation of significance and benefits of the study.

Data collection: three tools were used in this study:

Tool I: Questionnaire sheet was designed specifically for this study and contained:

1- Sociodemograhic data of the participant children and their parents including age, sex and residence.

2- Clinical history and clinical examination: all participant children were subjected to complete history-taking where previous HAV infection was determined from a history of clinical illness (jaundice, changed color of urine, isolation in fever hospital, vomiting, previous abnormal liver function tests). Previous vaccination was also determined from history. Children were subjected to a thorough medical examination to exclude the presence of any current liver disease. Any child with suspected liver disease or previous infection by HAV or vaccination by HAV vaccine was excluded from the study.

3- History of sanitary conditions as water supply, refuse and sanitary disposal and history of personal hygienic habits as washing hands before eating and after using WC and eating uncovered foods.

Tool II: determination of the Socioeconomic class was done according to Fahmy and Sherbini scale and classified as high, middle or low.[10]

Tool III: Blood samples collection: 5–10 mL of blood were obtained by venesection from each child. Serum samples were separated by centrifugation, coded and stored at –20 ºC until testing. Anti-HAV antibodies were detected in serum in a competitive binding assay based on ELISA techniques (Dia Sorin, Italy). Tests for total anti-HAV antibodies do not discriminate between different antibody classes. Although the presence of total anti-HAV is a signal of exposure to the virus, it does not distinguish between present and past infection and

therefore is mainly useful for epidemiological surveys.[11]

Results:

Table (1): shows the socio-demographic characteristics of study children. The majority of children were 6 year and older (82.3%) while 17.7 % of the were less than 6 years old. The male to female and rural to urban ratios were nearly equal. On the other hand nearly two thirds of children had low socioeconomic status (65.3 %), one fourth had moderate status and minority had high socioeconomic status (9.8 %).

Table (2): This table shows seroprevalence of hepatitis A virus antibodies (HAV Ab) by age, sex, socioeconomic status and residence. The overall seroprevalence of HAV Ab among study children was 57.3% (725 out of 1264) as shown in table (2) and figure (1). The seroprevalence of HAV Ab increased with age; 45.8%, 51.9% and 70.6% among children in the age groups of 4 - < 6, 6 – <12 and 12 - 18 years respectively (p=< 0.05). The seroprevalence of HAV Ab was slightly higher among male than females however, the difference was insignificant. The seroprevalence of HAV Ab was inversely proportional with the socio-economic level, it was 69.8%, 40.6% and 16.9% among children with low, moderate and high socio- economic status respectively and the difference was statistically significant (p=< 0.05). The seroprevalence of HAV Ab was significantly higher among rural than urban children (76.8% vs. 35.6%) (p=< 0.05).

Table (3): this table shows the relation between the seroprevalence of HAV Ab and environmental condition as water supply, refuse and sewage disposal and persona habits related to eating and hand washing. There were highly significant seroprevalence of HAV Ab among those using water supply outside home, non hygienic refuse and sewage disposal; 85.3%, 69.6% and 69.4% respectively (P=0,000, 0.0002, 0.000 respectively). Regarding personal

habits, seroprevalence of HAV Ab was significantly higher among those eating uncovered food outside home and those who did not hand wash before eating and after using WC; 72.8% and 76.4% respectively (P=0.0001 and 0.000 respectively).

Table (1): Socio-demographic characteristics of all study children tested for hepatitis A virus antibodies (HAV Ab)

Socio-demographic characteristics	n = 1264	%
Age:		
4 - < 6 years:	**223**	**17.7 %**
6 – <12 years:	**602**	**47.6 %**
12 - 18 years:	**439**	**34.7 %**
Sex:		
Male:	**623**	**49.3 %**
Female:	**641**	**50.7 %**
Socio-economic status:		
Low:	**825**	**65.3 %**
Middle:	**315**	**24.9 %**
High:	**124**	**9.8 %**
Residence:		
Rural:	**668**	**52.8 %**
Urban	**596**	**47.2 %**

Table (2): Seroprevalence of hepatitis A virus antibodies (HAV Ab) by age, sex, socioeconomic status and residence

Variable	HAV Ab			$\chi 2$	P-value
	Positive (n= 725) No %	Negative (n= 539) No %	Total (n= 1264) No %		
Age:					
4 - < 6 years:	102 45.8%	121 54.2%	223		
6 – <12 years:	313 51.9%	289 48.1%	602	37.8	0.000*
12 - 18 years	310 70.6%	129 29.4%	439		
Sex:					
Male:	378 60.7%	245 39.3%	623	1.003	0.32
Female:	347 54.1%	294 45.9%	641		
Socio-economic status:					
Low:	576 69.8%	249 30.2%	825	41.2	0.000*
Middle:	128 40.6%	187 59.4%	315		
High:	21 16.9%	103 83.1%	124		
Residence:					
Rural:	513 76.8%	155 23.2%	668	34.2	0.000*
Urban:	212 35.6%	384 64.4%	596		

** statistically significant*

Table (3): Seroprevalence of HAVAb by environmental conditions and personal habits

Variable	HAV Ab			χ^2	P-value
	Positive (n= 725)		Negative (n= 539)	Total (n= 1264)		
	No	%	No %	No %		
Water supply:						
Outside home	272	85.3	47 14.7	319	34.49	0.000*
Inside home	453	47.9	492 52.1	945		
Eating uncovered foods outside home: Yes	397	72.8	148 27.2	545	26.15	0.0001*
No	262	36.4	457 63.6	719		
Hand washing after eating and before WC use: Yes	112	24.2	350 75.8	462	53.6	0.000*
No	613	76.4	189 23.5	802		
Refuse disposal:						
Non Hygienic	604	69.6	264 30.4	868	25.8	0.0002*
Hygienic	121	30.6	275 69.4	396		
Sewage disposal:						
Non Hygienic	627	69.4	276 30.6	903	36.9	0.000*
Hygienic	98	27.1	263 72.9	361		

** statistically significant*

Figure (1): The overall sero-prevalence of HAV among study children.

Discusion:

Hepatitis A virus (HAV) infection is an important public health problem throughout the world and is the most common cause of acute viral hepatitis. Approximately 1.5 million new HAV infections are estimated to occur worldwide each year. In order to take appropriate preventive health care measures against hepatitis A and develop vaccination protocols in a region, it is very important to know the incidence of the disease.[12, 13]

The true incidence of HAV infection is not reflected in the number of reported cases of acute hepatitis A, since most infections are subclinical, particularly in children, and many cases are not reported. Determination of the anti-HAV antibodies in a population provides more reliable estimates of HAV infection prevalence.[14]

The prevalence of HAV infection closely correlates with the degree of environmental sanitation and the prevailing socioeconomic and hygienic conditions [11]. In Egypt, which is considered an area of high endemicity for HAV infection, marked economic, hygiene, and sanitary improvements have taken place especially in urban areas. Improvements in living conditions 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[15]. Salama et al. recorded a HAV prevalence of 86.2% in 2004. This may have public health implications as it indicates that a proportion of the adolescent and adult population may be at risk of HAV infection.[16]

The overall seropositivity of HAV Ab among our study children was 57.3% which is near the percentage reported by Abd Al-Aziz and Awad, (2008) [9] which was 61.4%. Another Egyptian study in 2004 recorded a higher prevalence of HAV Ab (86.2%) in children aged 3–18 years [16]. Other older Egyptian studies

also recorded a higher prevalence than ours [17,8]. Other endemic countries have reported variable results. A study in Saudi Arabia recorded 52.4% prevalence in children aged 1–10 years[18]. Higher prevalence was recorded in Turkish children, with 95% positivity in the age group 1–15 years[19]. In India, 84% of children aged 6 months to 18 years were positive for HAV antibodies[4]. Studies in Malaysia and Senegal recorded 40.9% and 93.1% seroprevalence respectively[20]. The difference between the previous results and ours may be due to variability in sampling from different areas with different sanitation facilities.

In the current study, the seroprevalence of HAV Ab was slightly higher among male than females however, the difference was insignificant. This finding agrees with Al Rashed et al., (1997) [18], Aggarwal et al. (1999)[4], Turk Aribas et al., (2000) [19] and, Al-Aziz and Awad (2008) [9]. In contrast Duval et al., (2005) in a Canadian study reported that, HAV Ab seroprevalence was significantly associated with female sex.[21]

The seroprevalence of HAV Ab increased with age; 45.8%, 51.9% and 70.6% among children in the age groups of 4 - < 6, 6 – <12 and 12 - 18 years respectively. Al-Aziz and Awad (2008) reported similar results (53.1% in age group 2.5–< 6 to 73.8% by age 9–18 years).[9] This result agrees with studies in different countries, in Saudi Arabia[18], Turkey[19], India [4], Brazil[22] and Cyprus[23].

In the current study, the seroprevalence of HAV Ab was inversely proportional with the socio-economic level, it was 69.8%, 40.6% and 16.9% among children with low, moderate and high socio- economic status respectively Similar results were reported by Abd Al-Aziz and Awad, (2008) [9] who showed that, the seropositivity of HAV Ab increased significantly with decreasing social class from 43.0% among children in the high social class to 87.5% in the low social class. This agrees with Al-Rashed et al., (1997)[18] who reported a prevalence of anti-HAV of 35%, 48.5% and 90% among high, middle and low

classes respectively. Also Das et al. (1998) in India reported a prevalence of 30.8% and 51.2% in persons with higher and lower socioeconomic status respectively.[24]

In our study, still 29.4% of those aged 18 years were seronegative for HAV Ab which is similar to the results of Al-Aziz and Awad, (2008) [9] who showed that, by the age of 18 years, still 35.3% were not immune. Improvements in general standards of sanitation have a paradoxical effect of greatly increasing the number of susceptible adults and creating the potential for large-scale epidemics[13]. In this situation, prophylaxis against hepatitis A has become increasingly important for this high-risk group

In the current study, there were highly significant seroprevalence of HAV Ab among those with non hygienic sanitary conditions water supply, sewage and refuse disposal) and poor personal hygienic habits (hand washing and eating habits). This agree with report of Hepatitis weekly, (2007) that, the prevalence of HAV infection closely correlates with environmental sanitation and the prevailing socioeconomic and hygienic conditions.[25]

Conclusions:

It can be concluded that, the overall seroprevalence of anti-HAV Ab in our sample was 57.3%. Anti-HAV Ab prevalence was statistically significantly higher with higher age, rural residence, lower socio-economic class and unhygienic personal habits and poor sanitary disposal. Although our sample cannot claim to be representative of the Egyptian population it may be representative of the Sohag area as the children were living in different areas of urban and rural Sohag.

Recommendations:

Education program for the population about mode of transmission of hepatitis A virus (HAV) infection and governmental efforts towards sanitary water supply,

hygienic refuse and sewage disposal specially in rural areas. Vaccination against HAV in Egypt should be kept in mind for children aged 12–18 years but after testing for HAV Ab.

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الإنتشار المصلي وعوامل الخطر المرتبطة بالإلتهاب الكبدي A بين الأطفال فى عمر المدرسة في محافظة سوهاج بصعيد مصر

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الملخص:

الخلفية: العدوى بإلتهاب الفيروس الكبدى الوبائي (أ) هي مشكلة صحية عامة مهمة في جميع أنحاء العالم، وخاصة في الأطفال ومستوطن في المناطق قليلة النظافة وذات الصرف الصحي المتدني.

الهدف من الدراسة: هو تحديد معدل الانتشار المصلي للفيروس الكبدى الوبائي أ بين الأطفال في سن المدرسة وعوامل الخطر المرتبطة بها في محافظة سوهاج.

المنهجية: في دراسة مستعرضة، شملت عينة من ١٢٦٤ طفل تتراوح أعمارهم بين ٤-١٨ عاما، تم اختيارها عشوائيا من العيادات الخارجية للأطفال وأمراض الجهاز الهضمي، مستشفى جامعة سوهاج. وتم الحصول على الموافقة المسبقة من أولياء أمورهم. استخدمت ثلاث أدوات لجمع البيانات: الأداة الأولى: ورقة الاستبيان تحتوي ١- البيانات الإجتماعية والسكانية من الأطفال المشاركين وأولياء أمورهم، ٢- التاريخ والفحص السريري، ٣- الظروف الصحية وإمدادات المياه، التخلص الصحي للفضلات والمخلفات وتاريخ العادات الصحية الشخصية. الأداة الثانية: تحديد الطبقة الاجتماعية والاقتصادية وفقا لمقياس فهمي والشربيني. الأداة الثالثة: جمع عينات الدم للكشف عن الأجسام المضادة للفيروس الكبدى الوبائي (أ) استنادا إلى تقنية ELISA. ولقد تم استبعاد الأطفال الذين يعانون من أمراض الكبد المزمن أو من سبق تطعيمهم ضد الفيروس الكبدى الوبائي (أ).

النتائج: كانت ٥٧.٣٪ من أطفال الدراسة إيجابية المصل للأضداد HAV. هناك علاقة ذات دلالة إحصائية بين الايجابية لأمصال الفيروس الكبدى الوبائي (أ) والوضع الإجتماعي والإقتصادي المنخفض، المعيشة بالريف، والفئة العمرية ١٢-١٨ عاما، إمدادات المياه من خارج المنزل، والتخلص غير الصحي من النفايات أوالفضلات الآدمية (P <0.05).

الاستنتاجات: الانتشار المصلي الشامل للفيروس الكبدى الوبائي (أ) في العينة كانت ٥٧.٣٪. كان الانتشار المصلي للفيروس الكبدى الوبائي (أ) أعلى بشكل ملحوظ مع التقدم في العمر، والإقامة الريفية، وانخفاض الطبقة الاجتماعية والاقتصادية والعادات الشخصية غير الصحية والتخلص غير الصحي النفايات واوالفضلات الأدمية.

التوصيات: برنامج تعليمى للسكان حول طريقة انتقال العدوى بإلتهاب الفيروس الكبدى الوبائي (أ) والجهود الحكومية نحو إمدادات المياه والصرف الصحي، النفايات الصحية والصرف الصحي وخاصة في المناطق الريفية. يجب أن يؤخذ التطعيم ضد الفيروس الكبدى الوبائي (أ) في مصر في الاعتبار بالنسبة للأطفال الذين تتراوح أعمارهم بين ١٢-١٨ عاما ولكن بعد اختبار الأجسام المضادة للفيروس الكبدى الوبائي (أ).