Journal of Environmental Studies [JES]
An International Journal
https://jesj.journals.ekb.eg/
doi: 10.21608/JESJ.2022.148170.1026

Study the prevalence of hepatitis A virus among patients of Sohag Governorate, Egypt

Fouad M. Talaat, El Adly A. Mohamed*, Wardany A. A., El-Shanawany, A. Ahmed.
Department of Botany and Microbiology, Faculty of Science, Al-Azhar University, Egypt

Citation: *Fouad M. Talaat, El Adly A. Mohamed*, Abd El Rady A. Wardany, El-Shanawany, A. Ahmed (2022). Study The prevalence of hepatitis a virus among patients of Sohag Governorate, Egypt. Journal of Environmental Studies, Vol. 27(1): 29-34.*

Article Information
Received 30 June 2022,
Revised 04 Aug. 2022,
Accepted 07 Aug 2022.
Published online
30 Sep. 2022

Abstract: Viral hepatitis is a major global public health problem affecting hundreds of millions of people and is associated with significant morbidity and mortality. Hepatitis A is caused by infection with hepatitis A virus (HAV), a non-enveloped RNA virus that is classified as a picornavirus. This study has been conducted to determine the prevalence rate of anti-HAV among community in Sohag governorate, Egypt. Our result shows the age distribution, gender and education type of population in all Sohag's cities (12) of Sohag governorate. The age distribution of the whole sample was mostly higher in age group above 50 years 34.3%, then 23% in age group from 20-30 years, then almost equally distributed in groups from 31-40 and 41-50 where they were 16.9%, and 17.1% respectively and finally the lowest in group less than 20 where it was 8.6%. The gender distributions of population in all Sohag's cities, males were more prominent (74.9%) than females (25.1%). The study shows the Anti-HAV distribution of population in all Sohag's cities, where only four participants were positive in Bailina, where the total prevalence of HAV was 0.4%. Four risk factors reflecting high mechanisms of HAV transmission have been associated with HAV infection including residing in rural areas, no education, blood transfusion and dental treatment. Exposures to surgery, history of schistosomiasis show no association with Anti-HAV. Among the community exposures, including blood donation but these associations are not important. We did not find abnormal levels of Biochemical analysis in HAV infected patients.

Keywords: Hepatitis A virus, Risk factors, schistosomiasis.

Introduction

Hepatitis is described as an inflammation of the liver (Lim & Suzuki, 2017; Mohamed, 2016; Saiedullah *et al*., 2016; Iezzi *et al*., 2017; Liao, 2017). It may be caused by drugs, alcohol use, or certain medical conditions. But in most cases, it is caused by a virus. This is known as viral hepatitis. Hepatitis A virus, the causative agent of type A viral hepatitis, is an ancient disease that has likely afflicted mankind since humans first began to live in groups large enough to sustain transmission of the causative agent, hepatitis A virus (HAV). In reviewing what was known as 'catarrhal jaundice' in 1912 (Lemon *et al*., 2018). Hepatitis A is the most common form of acute hepatitis in the world, with variations in the prevalence of infection reflecting local hygiene and sanitary standards (Koff, 1998; Cuthbert, 2001). The molecular cloning of the RNA genome of HAV in the early 1980s revealed its organisation to be similar to the genomes of poliovirus and other viruses classified within the family Picornaviridae. 5,6 HAV is now classified taxonomically within a unique picornaviral genus, the genus Hepatovirus, which includes only human HAV and other closely related mammalian viruses. Its single stranded, positive-sense RNA genome is approximately 7.5 kb in length, with a lengthy 50 untranslated RNA (UTR) segment covalently linked to a small virally encoded protein, VPg (or 3B), at its 50 terminus (Wang *et al*., 2015; Feng, 2013; Lemon, *et al*., 2018).

There are two forms of infectious virus. The first form of infectious HAV are Naked, non-enveloped HAV virions shed in the faeces of infected individuals are small, 27 nm diameter, icosahedral protein capsids within which the RNA genome is packaged **(**Wang *et al*., 2015**).** Quasi-enveloped virions (eHAV) that are secreted non-lytically from infected cells represent a second form of infectious virus **(**Feng *et al*., 2013**).** These virions are found in the blood of infected persons and in supernatant fluids of

* Corresponding author E-mail: ahmedeladly.ast@azhar.edu.eg

infected cell cultures and are comprised of RNA containing capsids enclosed within membranous vesicles that have no virally encoded proteins on their surface. They represent an unusual feature of HAV that has been recognized only recently, and that figures prominently in the pathogenesis of the infection (Lemon *et al*., 2018**)**.

HAV refers to liver inflammation caused by HAV infection where is one of several viruses that can cause hepatitis. The incubation period of HAV is 2 to 6 weeks with an average of 28 days. The HAV is shed in large numbers (>106 particles/g) in feces from the latter 2 weeks of the incubation period for up to 5 weeks. The major routes of food contamination by HAV include, fruits, vegetables and shellfish, which often become contaminated through contaminated water in their growing area or during preparation through contact with fecally contaminated surfaces or infected food handlers (Robertson *et al*., 2000). Recent food-borne outbreaks of hepatitis A have been associated with different types of canned soft fruit like strawberries (Anonymous, 1997), vegetables like green onions and lettuces (Bidawid *et al*., 2000) and frozen berries (Bruni *et al*., 2016). HAV is considered one of the most common illnesses through oral-fecal infection special in children and olds in poor developing country (Fan *et al*., 2006).

HAV antigen has been detected in stool, cell culture and environmental samples by using radio immuno assays and enzyme immunoassays (Hollinger & Emerson, 2001); ELISA in situ was performed to quantify the infectivity of HAV in cell culture (Costa *et al*., 2013). The main routine detection of HAV in food include the presence of inhibitory substances in the samples and the low concentration of virus recovered (Costa-Mattioli *et al*., 2002).

Materials and methods

Study area and data collection

This study has been conducted during the period from November 2016 till July 2017. The study has been carried out in twelve city of Sohag governorate, Egypt. The population was males and females less than 20 years old to over 50 years old, they were randomly selected. They were randomly selected. Consent forms were prepared, and approval of all subjects included in the study was obtained before blood was taken. In addition to the blood samples, all individuals were interviewed, and a questionnaire was filled to obtain information on age, place of living, education and other health care history. A total of seven hundred and forty-five blood samples were collected for the study.

Collection and processing of blood samples

Blood samples were collected from each subject by vene-puncture of the cubital veins. The site was cleaned thoroughly using 70% isopropyl alcohol in water and 1% iodine for one minute and allowed to dry. Taking precautions to avoid contamination of the site, about 3 milliliters of blood was collected using a sterile syringe and needle and dispensed into clean plastic. The blood samples were centrifuged at 4000 rpm for 10 minutes, and the serum obtained was stored at -20°C.

All serum samples were transported to the virology laboratory of botany and microbiology department, Al-Azhar University, Assiut branch; where all the processing has been carried out.

Serum Markers for HAV infection

Anti-HAV is studied using third-generation ELISA tests (Ortho Diagnostics, Raritan, NJ, USA; and Abbott Diagnostics, North Chicago, IL, USA). Results are read using EL x 800 universal micro-plate reader, (Biotek Instruments Inc.). All positive samples were retested using the same method (double ELISA).

Statistical analysis

The data collected was tabulated and analyzed by SPSS (statistical package for social science) version 25 (Armonk, NY: IBM Corp) on IBM compatible computer. The data was tested for normality using Kolmogorov–Smirnov test, Shapiro-Wilk tests. Two types of statistics were done, descriptive statistics and analytic statistics.

Result

Patients characteristics

The Age distribution among population in all cities of Sohag governorate, Egypt, where the age group below 20 years was more present in Dar El Salam, and age groups 20-30 years and 30-40 was the highest percentage in Gerga, and age group 40-50 years was the highest in Akhmim, and age group more than 50 was in Gehina The age distribution of the whole sample was mostly higher in age group above 50 years 34.3%, then 23% in age group from 20-30 years, then almost equally distributed in groups from 31-40 and 41-50 where they were 16.9%, and 17.1% respectively and finally the lowest in group less than 20 where it was 8.6% (Table 1).

In the present study the females were more prominent in Akhmim and males were more prominent in Monshah. The gender distribution of population in all Sohag's cities, males were more prominent (74.9%) than females (25.1%) (Table 1).

Table 1. Age distribution, gender and educational level of population in all cities of Sohag governorate.

Village	Age (N/%)						Gender (N/%)			Educational Level (N/%)			
	<20	20-30	31-40	41-50	>50	Total	Male	Female	Total	No education	School education	University education	Total
Akhmim	8/7.5%	14/13.1%	18/16.8%	26/24.3%	41/38.3%	107/100%	70/65.4%	37/34.6%	107/100%	39/36.4%	61/57%	7/6.5%	107/100%
Bailina	9/7%	39/30.5%	24/18.8%	19/14.8%	37/28.9%	128/100%	102/79.7%	26/20.3%	128/100%	17/13.3%	68/53.1%	43/33.6%	128/100%
Dar El Salam	12/15.8%	16/21.1%	15/19.7%	13/17.1%	20/26.3%	76/100%	61/80.3%	15/19.7%	76/100%	7/9.2%	46/60.5%	23/30.3%	76/100%
Gehina	6/6.9%	8/9.2%	10/11.5%	20/23%	43/49.4%	87/100%	58/66.7%	29/33.3%	87/100%	12/13.8%	57/65.5%	18/20.7%	87/100%
Gerga	7/7%	43/43%	23/23%	13/13%	14/14%	100/100%	74/74%	26/26%	100/100%	20/20%	43/43.0%	37/37%	100/100%
Maragha	4/6.7%	8/13.3%	11/18.3%	16/26.7%	21/35%	60/100%	42/70%	18/30%	60/100%	10/16.7%	28/46.7%	22/36.7%	60/100%
Monshah	3/7.7%	13/33.3%	5/12.8%	5/12.8%	13/33.3%	39/100%	32/82.1%	7/17.9%	39/100%	4/10.3%	22/56.4%	13/33.3%	39/100%
Osyrate	8/11.4%	20/28.6%	11/15.7%	9/12.9%	22/31.4%	70/100%	59/84.3%	11/15.7%	70/100%	9/12.9%	32/45.7%	29/41.4%	70/100%
Sagolta	8/10.1%	11/13.9%	11/13.9%	15/19.0%	34/43%	79/100%	57/72.2%	22/27.8%	79/100%	0/0%	47/59.5%	32/40.5%	79/100%
Sohag	6/6.7%	28/31.1%	11/12.2%	11/12.2%	34/37.8%	90/100%	69/76.7%	21/23.3%	90/100%	7/7.8%	32/35.6%	51/56.7%	90/100%
Tahta	7/11.1%	10/15.9%	12/19%	6/9.5%	28/44.4%	63/100%	47/74.6%	16/25.4%	63/100%	2/3.2%	29/46.0%	50.8%	63/100%
Tema	4/7.5%	9/17%	10/18.9%	10/18.9%	20/37.7%	53/100%	42/79.2%	11/20.8%	53/100%	6/11.3%	28/52.8%	19/35.8%	53/100%
Total	82/8.6%	219/23%	161/16.9%	163/17.1%	327/34.3%	952/100%	713/74.9%	239/25.1%	952/100%	133/14%	493/51.8%	326/34.2%	952/100%
Descriptive statistics:													

Table 2. Anti- HAV distribution of population in all cities of Sohag governorate, Egypt.

Village	Anti- HAV (N/%)		Total
	+Ve	-Ve	
Akhmim	0/0%	107/100%	107/100%
Bailina	4/3.1%	124/99.6%	128/100%
Dar El Salam	0/0%	76/99.6%	76/100%
Gehina	0/0%	87/99.6%	87/100%
Gerga	0/0%	100/99.6%	100/100%
Maragha	0/0%	60/100%	60/100%
Monshah	0/0%	39/100%	39/100%
Osyrate	0/0%	70/100%	70/100%
Sagolta	0/0%	79/100%	79/100%
Sohag	0/0%	90/100%	90/100%
Tahta	0/0%	63/100%	63/100%
Tema	0/0%	53/100%	53/100%
Total	4/0.4%	948/99.6%	952/100%
Descriptive statistics	+Ve; Positive, -Ve; Negative		

Seroprevalence of HAV-Ab distribution

The study shows the Anti-HAV distribution of population in all Sohag's cities, where only four participants were positive in Bailina, where the total prevalence of HAV was 0.4% (Table 2).

Residence distribution

The residence distribution of population in all cities of Sohag governorate, Egypt, shows high percentage of rural in Gerga, and urban in Gehina (Table 3).

Educational level

From the important information taken into account was the education distribution of population in all Sohag's cities, where the highest percentage of no education was in Akhmim, school education in Gehina, and university education in Sohag (Table 3).

Risk factors related to hepatitis viruses infection

Blood donation distribution

The history of Blood donation distribution of population in all Sohag's cities investigated where there was no history of blood donation in all participants (Table 3).

Blood transfusion distribution

The history of blood transfusion distribution of population in all Sohag's cities, where there was history of blood transfusion in only four participants from Bailina, and other two participants from Gerga (Table 3).

History of dental treatment

The history of dental treatment distribution of population in all Sohag's cities, where there was history of blood transfusion in only six participants from Bailina, three participants from Gerga, and other two participants from Akhmim (Table 3).

History of surgery distribution

Surgery distribution of population in all Sohag's cities was recorded, where there was history of surgical process in only four participants from Akhmim, two participants from Bailina, and other two participants from Gerga. (Table 3).

History of schistosomiasis distribution

Routine biochemical analysis among the studied patient showed that, no statistically significant difference between positive and negative participants for Anti-HAV (Table 4).

Table 3. Risk factors related prevalence of anti-HAV antibdies among population in all cities of Sohag governorate, Egypt.

Risk Factors	Anti- HAV		Total*	$\chi^{2©}$	P-value®	Risk Factors	Anti- HAV		Total*	$\chi^{2©}$	P-value®
	Yes	No					Yes	No			
Residence N/%						Blood Transfusion N/%					
Rural	4/0.9%	449/99.1%	453/100%	4.425	0.035*	Yes	0/0%	6/100%	6/100%	0.025	0.873
Urban	0/0%	499/100%	499/100%			No	4/0.4%	942/99.6%	946/100%		
Total	4/0.4%	948/99.6%	952/100%			Total	4/0.4%	948/99.6%	952/100%		
Gender N/%						Dental Treatment N/%					
Male	3/0.4%	710/99.6%	713/100%	0.00	0.996	Yes	0/0%	11/100%	11/100%	0.047	0.828
Female	1/0.4%	238/99.6%	239/100%			No	4/0.4%	937/99.6%	941/100%		
Total	4/0.4%	948/99.6%	952/100%			Total	4/100%	948/99.6%	952/100%		
Age N/%						Education Type N/%					
<20	4/4.9%	78/95.1%	82/100%	42.62	0.00	No Education	0/0%	133/100%	133/100%	3.74	0.154
20-30	0/0%	219/100%	219/100%			School Education	4/0.8%	489/99.2%	493/100%		
31-40	0/0%	161/100%	161/100%								
41-50	0/0%	163/100%	163/100%			University Education	0/0%	326/100%	326/100%		
>50	0/0%	327/100%	327/100%								
Total	4/0.4%	948/99.6%	952/100%			Total	4/0.4%	948/99.6%	952/100%		
Schistosomiasis N/%						Surgery N/%					
Yes	0/0%	13/100%	13/100%	0.056	0.814	Yes	0/0%	8/100%	8/100%	0.034	0.854
No	4/0.4%	935/99.6%	939/100%			No	4/0.4%	940/99.6%	944/100%		
Total	4/0.4%	948/99.6%	952/100%			Total	4/0.4%	948/99.6%	952/100%		

*; Student t-test, ©; Chi-square test (χ2), ®; P-value of < 0.05.

Table 4. Association between Biochemical analysis and Anti-HAV Antigen of population in all cities of Sohag governorate, Egypt.

Anti- HAV	Yes			No			U	P-value
	Mean ± SD			Mean ± SD				
SGOT	30.00	±	9.09	28.07	±	13.02	1531	0.505
SGPT	27.00	±	7.87	25.45	±	11.08	1452	0.418
T. Bilirubin	0.83	±	0.15	0.77	±	1.17	1057	0.118
Haemodialysis %	13.80	±	0.88	13.52	±	5.41	1334	0.305
RBCs	4.59	±	0.33	4.56	±	1.22	1495.5	0.465
Student t-test								

Discussion

The study shows the Anti- HAV distribution of participants in all cities of Sohag governorate, Egypt, where only four participants were positive in Bailina, the total prevalence of HAV was 0.4%. The Anti-HEV and Anti- HDV distribution of participants in all Sohag's cities was negative in all participants. In a study by **(**Talaat *et al*., 2019**)** between 2014 and 2017, among 9321 patients enrolled, 8362 (89.7%) had one or more markers of HAV including 7806 (93.4%) HAV**.** This study results showed the age distribution of participants in all Sohag's cities, where the age group below 20 years was more present in Dar El Salam, and age groups from 20 to 30 years and from 30 to 40 was the highest percentage in Gerga, and age group from 40 to 50 years was the highest in Akhmim, and age group more than 50 was in Gehina. The age distribution of all participants was mostly higher in age group above 50 years 34.3%, then 23% in age group from 20 to 30 years, then almost equally distributed in groups from 31 to 40 and 41 to 50 where they were 16.9%, and 17.1% respectively and finally the lowest in group less than 20 where it was 8.6%. There was highly statistically significant association between age and Anti- HAV of participants, where HAV was associated with young age where all cases were younger than 20 years. In agreement with our results is the finding of Talaat *et al*., (2019) who

recorded that the HAV infection occurred most commonly among children < 16 years age.

The gender distribution of all participants in all Sohag's cities, where the females were more prominent in Akhmim and males were more prominent in Monshah. There was no association between gender and Anti- HAV of participants where the four positive participants were 3 males and one female. There was highly statistically significant association between residence and Anti- HAV of participants, where HAV was associated with rural residence where all positive patients were rural. On the contrary, there was no association between education and Anti- HAV of participants where prevalence was 0.8% in school education group only. Also, there was no association between history of blood transfusion, dental treatment, history of surgery, history of schistosomiasis on the one hand, and Anti- HAV of participants on the other.

The study shows that there was no statistically significant difference between positive and negative participants for Anti-HAV. Where SGOT mean± SD. Was 30.00±9.09, and 28.07±13.02, SGPT mean± SD. Was 27.00±7.87, and 25.45±11.08, T. Bilirubin mean± SD. was 0.83±0.15, and 0.77±1.17, Haemodialysis % mean± SD. was 13.80±0.88, and 13.52±5.41, RBCs mean± SD. Was 4.59±0.33, and 4.56±1.22.

References

Anonymous, (1997). Hepatitis A associated with consumption of frozen strawberries. *Morbidity and Mortality Weekly Report*, 46: 288-289.

Bidawid, S., Farber, J.M., Sattar, S.A. (2000). Rapid concentration and detection of hepatitis Avirus from lettuce and strawberries. *Journal of Virological Methods*, 88: 175-185.

Bruni, R., Taffon, S., Equestre, M., Chionne, P., Madonna, E., Rizzo, C., *et al*. (2016). Key role of sequencing to trace hepatitis A viruses circulating in Italy during a large multi-country European foodborne outbreak in 2013. *PLoS ONE*, 11(2): e0149642.

Costa, A.M., Amado, L.A., Paula, V.S. (2013). Detection of replication-defective hepatitis A virus based on the correlation between real-time polymerase chain reaction and ELISA in situ results. *Memórias do Instituto Oswaldo Cruz*, 108: 36–40.

Costa-Mattioli, M., Monpoeho, S., Nicand, E., Aleman, M.H., Billaudel, S., Ferre, V. (2002). Quantification and duration of viraemia during hepatitis A infection as determined by real-time RT-PCR. *Journal of Viral Hepatitis*, 9: 101-106.

Cuthbert, J.A. (2001). Hepatitis A: old and new. *Clinical microbiology reviews*, 14(1): 38-58.

Fan, D., Wang, C., Zhang, Y., Li, X. and Wang, X. (2006). The seroepidemiological investigation of HAV among the population aged from 1 to 15 years in HAV outbreak area in Yili Prefecture. *Disease Surveill*, 21(10): 526–528.

Feng, Z., Hensley, L., McKnight, K.L., Hu, F., Madden, V., Ping, L., Lemon, S.M. (2013). A pathogenic picornavirus acquires an envelope by hijacking cellular membranes. *Nature*, 496(7445): 367-371.

Hollinger, F.B., Emerson, S.U. (2001). Hepatitis A virus, *Journal of Fields Virology*, 4th ed. 799 - 840.

Iezzi, M., Bruzzi, P., Lasorella, S., Predieri, B., di Pianella, A.V., Iughetti, L. (2017). Effect of Weight Loss on Markers of Inflammation and Endothelial Function in Childhood Obesity. *Journal of Obesity*, 7(1): 1-6.

Koff, R.S. (1998). Hepatitis a. *The Lancet*, 351(9116), 1643-1649.

Lemon, S.M., Ott, J.J., Van Damme, P., & Shouval, D. (2018). Type A viral hepatitis: A summary and update on the molecular virology, epidemiology, pathogenesis and prevention. *Journal of Hepatology*, 68(1): 167-184.

Liao, J., (2017). Cigarette Smoke-Induced Chronic Inflammation Leading to COPD and Lung Cancer: A Multiscale Modeling Study. *Journal of Immunobiology*, 02 (01).

Lim C. and Suzuki K. (2017). Systemic Inflammation Mediates the Effects of Endotoxemia in the Mechanisms of Heat Stroke. Biology and Medicine.; 09(01).

Mohamed, S.A.M. (2016). Role of Genetic Testing in Lung Transplantation; Prediction of Inflammation. *Journal of Genetic Syndromes & amp; Gene Therapy*, 07(03).

Robertson, B.H., Averhoff, F., Cromeans, T., Han, X., Khoprasert, B., Nainan, O.V., et al. (2000). Genetic relatedness of hepatitis A virus isolates during a community-wide outbreak. *Journal of Medical Virology*, 62(2): 144 -150.

Saiedullah, M., Rahman, M., Hai, Siddique, M. (2016). Atherogenic Index and Female Gender are Independent Determents of Chronic Subclinical Inflammation in Subjects with Type 2 Diabetes Mellitus. *Diabetes Case Reports*, 01 (03).

Talaat, M., Afifi, S., Reaves, E., Abu Elsood, H., El-Gohary, A., Refaey, S., *et al*. (2019). Evidence of sustained reductions in the relative risk of acute

hepatitis B and C virus infections, and the increasing burden of hepatitis a virus infection in Egypt: comparison of sentinel acute viral hepatitis surveillance results, 2001–17. *BMC Infectious Diseases*, 19(1).

Wang, X., Ren, J., Gao, Q., *et al*. (2015). Hepatitis A virus and the origins of picornaviruses. *Journal of Nature*, 517: 85‑88.