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Seroprevalence and risk factors of Hepatitis E infection in Jordan's population: First report

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ABSTRACT

Objectives: Hepatitis E virus (HEV) is hyperendemic in many countries, but data on this virus are not available in Jordan. This study determined the seroprevalence, risk factors and zoonotic potential of HEV in a Jordanian population.
Methods: A total of 450 sera samples from 8 different governorates were tested for HEV-IgG. A pre-tested and validated questionnaire was used to collect risk factor data including animal interaction and environmental exposures.
Results: The overall seroprevalence was 30.9%. Eating undercooked meat was significantly associated with HEV seropositivity (OR = 2.06, 95%CI 1.04–4.06) after controlling for age, gender, travel history and source of water. Age was also associated with HEV seropositivity; the youngest (≤14 years of age) and oldest age groups (60 and 80 years of age) had the highest prevalence (45.5% and 53.2%, respectively), compared to those between 20 to 29 years of age and 30 to 39 years of age (20.2 and 15.2%, respectively), although the small sample size among the youngest group tempers this association. There was evidence of a marginal association between owning camels and an increased odds of HEV seropositivity. Place of residence and source of drinking water were not associated with infection.
Conclusion: This is the first study to report HEV seroprevalence in Jordan and shows that HEV exposure is high in Jordan. Surveillance for acute and chronic Hepatitis E is needed to estimate the frequency of the actual disease.

Introduction

Hepatitis E virus (HEV) is a single-strand RNA virus classified in the genus Hepevirus, family Hepeviridae and can lead to acute disease with symptoms ranging from subclinical (where patients clear the virus rapidly) to fulminant hepatitis (symptoms can include fever, anorexia, vomiting, nausea, myalgia and jaundice) (Teo, 2010; Yugo and Meng, 2013). To date, five genotypes (HEV-1 through HEV-4 and HEV-7) have been found in humans (Aggarwal and Gandhi, 2010; Lee et al., 2016). HEV-1 and HEV-2 primarily infect humans via the fecal-oral route and have been the main source of large waterborne HEV outbreaks in low- and middle-income countries (LMICs) (Dalton et al., 2008; Mirazo et al., 2014). HEV-3 (in Europe and United States) and HEV-4 (in China, Japan and Southern Europe) outbreaks in humans have been associated with zoonotic exposure, including pork product consumption and handling (Chalupa et al., 2014; Dalton et al., 2008, 2014; Krumbholz et al., 2012, 2014a; Romanò et al., 2011; Wichmann et al., 2008). Moreover, recently, HEV-7 was reported in one person in the United Arab Emirates and was linked to consumption of camel products (Lee et al., 2016).

HEV has been identified in the environment and in food, including in untreated water, shellfish, produce, and meat (Teo, 2010; Yugo and Meng, 2013). In addition, HEV has been detected in swine in the US, Japan, Madagascar, and several European countries such as Spain, Germany and the Netherlands (Grierson et al., 2015; Huang et al., 2002; Oliveira-Filho et al., 2014; Primadharsini et al., 2017; Rutjes et al., 2009; Seminati et al., 2008; Temmam et al., 2013). Although the virus has not been isolated from ruminants, serological studies in the United States, Egypt, India, China and Spain have detected anti-HEV antibodies in these animals (Arankalle et al., 2001; El-Tras et al., 2013; Peralta et al., 2009; Sanford et al., 2013; Yan et al., 2016). In addition, HEV-7 has

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recently been isolated from dromedary camels in North and East Africa, UAE and Pakistan (Rasche et al., 2016; Woo et al., 2014).

Sporadic cases and clusters of hepatitis E have been reported with increasing frequency in several European countries including the United Kingdom, Denmark, Spain, France, the Netherlands, Hungary, Germany and Norway (Lewis et al., 2010). In contrast, HEV is considered hyperendemic in several LMICs including Egypt, China, Bangladesh, India and Mexico (Teo, 2010) with HEV epidemics also described elsewhere in the Middle East and North Africa (MENA) (Algeria, Libya, Morocco, Israel and Turkey) (Aggarwal and Gandhi, 2010; Erez-Granat et al., 2016). In MENA, hepatitis E accounts for a variable proportion (20–60%) of acute hepatitis cases, and seroprevalence of anti-HEV antibodies has been up to 20%, with Egypt reporting up to 80% (Aggarwal and Gandhi, 2010). Despite the growing global threat of HEV, its existence in neighboring countries and the possible link to animal and environmental exposures, the epidemiology of HEV and risk factors remain unknown in Jordan. Thus, this study aimed to explore the seroprevalence of anti-HEV antibodies and associated risk factors in Jordan.

Materials and methods

Study design and population

Jordan is an upper middle-income country located in the MENA region with a population of 7.6 million, and a life expectancy of 74 years (World Bank, 2016). For this cross-sectional study we analyzed 450 blood samples collected during a cross-sectional zoonotic disease study conducted in Jordan between November 2015 to May 2016 (the parent study).

Setting

Between two to six governmental health centers per each of the eight governorates were included in the study. Centers were selected randomly from the Ministry of Health directory. All blood samples were collected by registered nurses and medical professionals. Sera were stored at the health care centers at −20 °C until shipment to the Food Safety and Zoonotic Diseases Laboratory at Jordan University of Science and Technology (JUST).

Table 1
Prevalence of anti-Hepatitis E IgG, unadjusted and adjusted odds ratios (OR) for HEV in Jordan, 2015–2016.[a]

	No. HEV+/No. tested	% Positive	Unadjusted OR	*p*-value	Adjusted OR (95% CI)
Seropositive	139/450	30.89			
Age, continuous, years	37.5	NA	1.03	<0.000	1.02 (1.01–1.04)
Age					
<15	5/11	45.5	2.15	0.27	NA
15–19	12/43	27.9	1	NA	NA
20–29	25/124	20.2	0.65	0.29	NA
30–39	10/66	15.2	0.46	0.11	NA
40–49	31/97	32	1.21	0.63	NA
50–59	31/62	50	2.58	0.03	NA
60–80	25/47	53.2	2.94	0.02	NA
Female	67/247	27.1	1	NA	1
Male	72/203	35.5	1.48	0.06	1.32 (0.86–2.01)
Rural residence	79/251	31.5	1	NA	NA
Urban residence	60/199	30.2	0.94	0.76	NA
Lives in an apartment	50/150	33.3	1	NA	NA
Lives in a house	89/300	29.7	0.84	0.43	NA
No education	49/117	41.9	1	NA	NA
Any education	90/333	27.0	0.51	0.003	0.64 (0.39-1.03)
Household Income					
Less than 750 USD	98/312	31.4	1	NA	NA
More than 750 USD	41/138	29.7	0.92	0.72	NA
Travel history					
Never lived abroad	114/391	29.2	1	NA	NA
Ever lived abroad	25/59	42.4	1.79	0.04	1.53 (0.85–2.78)
Water source[b]					
Rain collection cistern	15/47	31.9	1.05	0.87	NA
Filtered water	78/264	29.55	0.86	0.46	NA
Municipality Water	53/162	32.7	1.14	0.53	NA
Spring lakes	8/16	50.0	2.31	0.10	1.25 (0.42–3.71)
Eat undercooked meat[c]	21/44	47.7	2.23	0.01	2.06 (1.04–4.06)
Drinks raw milk[d]	20/52	38.5	1.46	0.22	NA
Eat traditional wild herbs[e]	86/259	33.2	1.29	0.22	NA

[a] Denominator was 450 unless otherwise noted.
[b] Water sources were not mutually exclusive, some respondents named 2 water sources. The reference group is any other water source.
[c] Compared to not eating undercooked meat.
[d] Compared to not drinking raw milk.
[e] Compared to not eating traditional wild herbs.