

Seroprevalence of Antibodies to Hepatitis E Virus Among Pregnant Women

Mojgan Mamani¹; Mehrangiz Zamani²; Seyyed Hamid Hashemi¹; Fariba Keramat^{1,*}

¹Brucellosis Research Center, Hamadan University of Medical Sciences, Hamadan, IR Iran

²Department of Obstetrics and Gynecology, Fatemeh Hospital, Hamadan University of Medical Sciences, Hamadan, IR Iran

*Corresponding author: Fariba Keramat, Brucellosis Research Center, Hamadan University of Medical Sciences, Hamadan, IR Iran. Tel: +98-918113281, E-mail: faribakeramat@yahoo.com

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Background: Hepatitis E virus (HEV) infection is a major public health problem in developing countries, which could progress to an acute self-limited hepatitis. Young adults and middle-aged people are more likely to be infected than children and elderly persons. The disease is usually mild in general population; severe infection is more seen among pregnant women and leads to a high rate of mortality in this population.

Objectives: This study aimed to assess seroprevalence of HEV infection and related risk factors among pregnant women referred to Fatemeh Hospital in Hamadan, Iran.

Patients and Methods: A total of 1050 pregnant women were included in this prospective cross-sectional study, conducted from 2010 to 2011. Anti-HEV specific IgG was measured with ELISA method. A questionnaire containing research purposes was also fulfilled for each participant.

Results: The mean age of pregnant women was 27.2 ± 5.6 years. The overall seroprevalence of anti-HEV was 7.4%. There was a significant association between anti-HEV seropositivity and age ($P < 0.001$), degree of education ($P = 0.017$), number of household members ($P = 0.002$), siblings ($P = 0.005$), and parities ($P = 0.007$). However, no significant relationship was observed between positive anti-HEV and variables such as place of residence, occupation, history of animal contacts, agricultural activities, type of drinking water, and the method of washing vegetables ($P > 0.05$).

Conclusions: According to the results, 92.6% of pregnant women were anti-HEV negative. However, there is no available effective vaccine for its prevention in human yet. Therefore, education about environmental and personal hygiene before and during pregnancy may be helpful for decreasing the rate of HEV infection in this high risk population.

Keywords: Hepatitis E Virus; Seroprevalence; Pregnancy; Iran

1. Background

Hepatitis E virus (HEV) infection is a major public health problem in developing countries, which could lead to an acute self-limiting hepatitis (epidemic or sporadic). It is the most common cause of fulminant hepatic failure in areas with endemic HEV infection (1, 2). In these areas, poor individual and public sanitation may lead to fecal-oral transmission of HEV and consequently large outbreaks may occur through contaminated water and foods. The endemic regions for this infection include large areas in Asia, Africa, the Mediterranean region, Mexico, and South America (3).

The young adults and middle-aged populations are more likely to be infected than children and elderly persons (3, 4). Although the disease is usually mild in general population, severe infection is more seen among pregnant women, which leads to a high rate of mortality in this population (2, 5-7). The mortality rate of pregnant women with HEV infection has been reported about 25%, which is much higher than general population (8). It is more important in the third trimester and has been reported to be associ-

ated with the mortality rate of 80% in HEV-induced fulminant hepatic failure cases in this trimester (9). Moreover, hepatitis E virus in pregnancy is associated with spontaneous abortions, stillbirths, low birth weight, and preterm labors (2-4, 10). Some studies have demonstrated that the severity of infection was related to the changes in hormones and immune system during pregnancy (11, 12).

Several reports from Iran indicated that the seroprevalence of HEV was more than 5% in population-based studies. Thus, Iran is classified as an endemic area for HEV infection. The prevalence of HEV infection has been reported around 7% in center and northwest of Iran (Tehran and Tabriz) and 11% in southwest of Iran (Khuzestan) among blood donors (13-15). Two epidemic outbreaks were reported in 1991 and 1992 in Kermanshah and Lordegan (located in the west of Iran), respectively (10). Hamadan is located in central west of Iran in neighboring the epidemic HEV region in Kermanshah province. Previous report in Hamadan province (Nahavand City) showed a rate of 9.3% for seroprevalence of HEV (16).

2. Objectives

This study aimed to assess seroprevalence of anti-HEV antibodies and related risk factors among pregnant women referred to Fatemieh Hospital in Hamadan, Iran.

3. Patients and Methods

3.1. Design

This was a prospective cross-sectional study.

3.2. Duration

The study was performed from February 2010 to April 2011.

3.3. Setting

The study was conducted on pregnant women referred to Fatemieh Hospital, a tertiary care center in Hamadan, west of Iran.

3.4. Sampling Technique

The study protocol was approved by the Ethics Committee of Hamadan University of Medical Sciences and was carried out in accordance with the ethical standards of the Declaration of Helsinki (1975, revised in 1983). Prior to the participating in the study, the scope and purpose of the study was explained to the pregnant women and a written informed consent was obtained from all participants.

3.5. Data Collection

A total of 1050 pregnant women were enrolled in the study. Then, a 3-mL blood sample was drawn from each subject for HEV analysis while collecting specimens for routine investigations, and also serum was separated by centrifugation and stored at -70°C. Specific IgG antibody for HEV (anti-HEV) was measured using a third generation enzyme immunoassay (EIA, DiaPro, Milan, Italy). A questionnaire was used to gather sociodemographic data and additional information in accordance to the proposed structure, including source of water and sanitary condition. An available sampling method was used for selection of the participants.

3.6. Data Analysis

Descriptive statistics include frequency distribution tables. Mean and standard deviations (SD) were generated with the SPSS (Chicago, Illinois, USA, version 17) statistical software. Chi-square or Fisher exact test were used to compare categorical variables and an independent t test or Mann-Whitney test was used to compare between means. A P value less than 0.05 was considered as statistical significance level.

4. Results

Totally, 1050 pregnant women were included in the study. Table 1 shows the demographic data of the included women. The mean age of participants was 27.2 ± 5.6 (range: 14 - 49) years. Of the study population, 725 participants (69%) lived in urban area, 975 women (92.9%) were housewives, and 570 of them (54.3%) had education lower than high-school diploma. Four hundred and ninety-eight women (47.4%) lived in a two-person household and 531 of them (50.6%) had more than four siblings. Of the participants, 511 women (48.7%) were primipara and 495 (47.1%) were in the first trimester of pregnancy. Of the pregnant women, 111 (10.6%) participants had history of animal contacts and 153 (14.6%) cases had agricultural activity. Ninety-nine percent (1039 cases) used tap water for drinking and 49.6% (520 cases) used detergents for washing vegetables.

Table 1. Demographic Characteristics of the Pregnant Women ^a

Variables	Subject (n = 1050)
Age, yr	
Mean \pm SD	27.2 \pm 5.6
Range	14-49
Live in	
Urban area	725 (69)
Rural area	325 (31)
Education	
Illiterate	65 (6.2)
Lower than high-school diploma	570 (54.3)
High-school diploma or higher	415 (39.5)
Occupation	
Housewife	976 (92.9)
Employee	61 (5.8)
Other	13 (1.2)
Number of person household	
2	498 (47.4)
2-4	481 (45.8)
More than 4	71 (6.8)
Number of sisters and/or brothers	
1	158 (15)
2-4	361 (34.4)
More than 4	531 (50.6)
Parity	
1	511 (48.7)
2	339 (32.3)
More than 2	200 (19)

^a Data are presented as No. (%).

There were 78 (7.4%) women with a positive anti-HEV serology. Table 2 shows the comparison of epidemiologic and demographic characteristics between positive and negative anti-HEV groups. The mean ages of positive and negative groups were 30.1 ± 5.8 and 26.9 ± 5.6 , respectively and there was a significant difference between two groups ($P < 0.001$).

Also, positive anti-HEV results were correlated negative-

ly with women's educational degree ($P = 0.017$) and positively with the number of their household members ($P = 0.002$), siblings ($P = 0.005$), and parities ($P = 0.007$). However, no significant relationship was observed between positive serology and the variables of place of residence, occupation, history of animal contacts, agricultural activities, as well as type of drinking water and the method of washing vegetables ($P > 0.05$).

Table 2. Comparison of epidemiologic and Demographic Characteristics between Positive and Negative Anti-HEV Pregnant Women^a

Variables	Anti-HEV Serology		P Value
	Positive (n = 78)	Negative (n = 972)	
Age, yr	30.1 ± 5.8	26.9 ± 5.6	< 0.001
Live in			0.136
Urban area	48 (6.6)	677 (93.4)	
Rural area	30 (9.2)	295 (90.8)	
Education			0.017
Illiterate	9 (13.8)	56 (86.2)	
Lower than high-school diploma	48 (8.4)	522 (91.6)	
High-school diploma or higher	21 (5.1)	394 (94.9)	
Occupation			0.105
Housewife	69 (7.1)	906 (92.9)	
Employee	8 (13.1)	53 (86.9)	
Other	1 (7.1)	13 (92.9)	
Number of household members			0.002
2	23 (4.6)	475 (95.4)	
2-4	45 (9.4)	436 (90.6)	
More than 4	10 (14.1)	61 (85.9)	
Number of sisters and/or brothers			0.005
1	4 (2.5)	154 (97.5)	
2-4	22 (6.1)	339 (93.9)	
More than 4	52 (9.8)	479 (90.2)	
Parity			0.007
1	25 (4.9)	486 (95.1)	
2	31 (9.1)	308 (90.9)	
More than 2	22 (11)	178 (89)	
Trimester			0.137
1	29 (5.9)	466 (94.1)	
2	29 (8.2)	326 (91.8)	
3	20 (10)	180 (90)	
Contact with animals			0.390
Yes	6 (5.4)	105 (94.6)	
No	72 (7.7)	867 (92.3)	
Agricultural activity			0.832
Yes	12 (7.8)	141 (92.2)	
No	66 (7.9)	831 (92.1)	
Drinking water			0.426
Tap water	78 (7.5)	961 (92.5)	
Well water		11 (100)	
Washing vegetables			0.383
Using pure water	29 (7.4)	364 (92.6)	
Using detergents	35 (6.7)	485 (93.3)	
Using disinfectants	14 (10.2)	123 (89.8)	

^a Data are presented as Mean ± SD or No. (%).

5. Discussion

This study indicated that the overall seroprevalence of anti-HEV was 7.4% among pregnant women in Hamadan. Reports from Africa demonstrated a rate of 12% in Tunisia (17), 14% in Gabon (18), 28% in Ghana (19), and 84% in Egypt (20) for anti-HEV seroprevalence among pregnant women. In addition, a study in Indian pregnant women showed a prevalence of 33% for anti-HEV seropositivity (21). Although African and Indian studies showed higher rates of HEV infection than our study, an investigation in Turkey (22) showed that 7% of pregnant women were seropositive for anti-HEV, which was similar to the present study. These differences between studies could be related to ecological, environmental, and cultural variations as well as differences in the hygiene level, access to safe water sources, and sanitary sewage disposal systems in the studied communities.

In the present study, the positive HEV group had a higher mean age than negative HEV group. In Hannachi's study in Tunisia, females older than 30 years were considered as an independent factor (17). Also, studies by Cevrioglu (23) and Stoszek (20) indicated that the age was correlated with higher rate of anti-HEV seropositivity. The relationship between age and anti-HEV seropositivity can reflect the link between the exposure and infection.

In this study, another associated factor with anti-HEV seroprevalence was degree of education. The results indicated that the rate of positive anti-HEV women increased with lower education degrees. Similarly in Turkish study, the rate of HEV seropositivity was significantly higher in women with a lower education degree (9.7%) compared to women with a higher education degree (22). It indicates the positive impact of education on sanitation and hygiene practice among women.

The results of this study showed a positive association between anti-HEV seropositivity and the size of family as well as the number of pregnancies. Similarly, some other studies demonstrated that the number of persons per room in the house was an independent factor for predicting HEV infection (17, 24). Also, having more than four siblings was a risk factor for HEV infection in an Egyptian study (20).

The present study showed that history of animal contact, agricultural activity, type of drinking water, and method of washing vegetables had no effect on seropositivity of anti-HEV in pregnant women. Despite our findings and the results of studies from Tunisia (17) and Turkey (22) regarding this issue, an Egyptian study (20) found association of anti-HEV with cat contact as well as using soap for washing fruits and vegetables. An Indian study (21) also found its association with the source of drinking water. However, 99% of our study population used tap water, which could be a reason for difference between the findings of mentioned studies and the present study.

In conclusion, according to the results, most of the pregnant women were anti-HEV negative. Although re-

combinant hepatitis E vaccine is being studied and its consumption in non-human primates had promising results, there is no available effective vaccine for prevention in human yet (25). Therefore, with respect to the importance of HEV infection in pregnancy, its high mortality rate among pregnant women, and its route of transmission, education before and during pregnancy regarding environmental and personal sanitation may be helpful for decreasing the rate of infection. These measures become more important during HEV infection epidemics in our neighboring province (Kermanshah). The authorities should also be informed about the necessary plans and decisions in this regard.

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Authors' Contributions

All authors contributed in the study concept and design, drafting of the manuscript, critical revision of the manuscript, study supervision, acquisition of data, analysis and interpretation of data, as well as drafting of the manuscript.

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