Epidemiology of Hepatitis B in the Reproductive-Age Female Farmworkers of Southeastern Turkey

Nebiye Yentur Doni [1,*]; Zeynep Simsek [2]; Zehra Keklik [2]; Gulcan Gurses [1]; Fadile Yildiz Zeyrek [3]

[1]Department of Medical Microbiology, Vocational School of Health Services, Harran University, Sanliurfa, Turkey
[2]Department of Public Health, Faculty of Medicine, Harran University, Sanliurfa, Turkey
[3]Department of Medical Microbiology, Faculty of Medicine, Harran University, Sanliurfa, Turkey

*Corresponding Author: Nebiye Yentur Doni, Department of Medical Microbiology, Vocational School of Health Services, Harran University, Sanliurfa, Turkey. Tel: +90-4143183212, Fax: +90-4143183211, E-mail: n_doni@hotmail.com

Background: There are limited data on the prevalence of the hepatitis B virus (HBV) infection in the agricultural population worldwide.
Objectives: This study aimed to determine the prevalence of HBV infection and associated risk factors in the reproductive-age female farmworker.
Materials and Methods: This cross-sectional study was conducted between January and April 2013 in southeastern region (SAR) of Turkey. A community-based representative agricultural sample (n = 705) from the agricultural areas of nine provinces of SAR was randomly determined by clustering method using Epi Info software. Questionnaires including demographic information and risk factors of HBV were administered to participants. The presence of HBsAg, anti-HBs, anti-HBc, and anti-HBe antibodies in blood samples were measured by ELISA.
Results: The prevalence of the HBsAg, anti-HBs, anti-HBc, anti-HBe antibodies, and seropositivity were 5.7%, 25.9%, 28.9%, 16.4%, and 36.7%, respectively. There was no association between the HBsAg and the size of the household, age, education level, parity, and place of birth while the prevalence of HBsAg was higher in seasonal migratory farmworkers and people living in urban areas and the prevalence of anti-HBs antibody was significantly higher in women ≥ 35 years of age, those with a high parity, and those who gave birth without the assistance of health professionals (P < 0.05). The risk for HBV infection in the seasonal migratory group was 4.3 times higher in comparison to local workers (P = 0.00; OR = 4.3; 95% CI, 2.2-8.4), with a prevalence rate of 11%.
Conclusions: The monitoring of at-risk groups like seasonal migratory farmworkers is necessary to strengthen the healthcare service provided to this population.

Keywords: HBsAg; ELISA; Agriculture

1. Background

The hepatitis B virus (HBV) causes hepatitis B and is a serious and common infectious disease with a worldwide distribution. According to World Health Organization (WHO) data, it is estimated that more than two billion people have been infected with the HBV worldwide. Of these, globally, around 240 million people are chronically infected and are at risk of serious illness and death, mainly from liver cirrhosis and hepatocellular carcinoma (1, 2). Mathematic modelling for the year 2000 estimated the number of deaths from HBV-related diseases at between 500000 and 700000 deaths each year (3). The highest hepatitis B surface antigen (HBsAg) carrier rates were found in developing countries with primitive or limited medical facilities (4, 5). In the WHO European region, over 13 million adults are living with hepatitis B (1). In southeastern Asia, it is estimated that 160 million people have chronic HBV infections and annually more than 360000 HBV-related deaths occur (3). The endemicity of hepatitis B, which is described by the prevalence of HBsAg in the general population of a defined geographical area, varies considerably regarding geographic region. HBsAg prevalence of > 8% is typical of highly-endemic areas and prevalence of 2% to 7% is found in areas of intermediate endemicity, whereas in areas with low endemicity, < 2% of the population is HBsAg-positive. Turkey is located in an endemic region with an intermediate prevalence of HBV (2). In a meta-analysis consisting of seroprevalence studies published between 1999 and 2009, the overall population HBsAg prevalence was estimated at 4.6% in Turkey and approximately 3.3 million people were determined as chronic hepatitis B cases (6). According to the International Labour Organization, agriculture is the second greatest source of employment worldwide, with over one-third of the world's workforce (1.3 billion people) depending on agriculture. Agriculture is the most important sector for female employment in many countries, and especially in Africa and Asia (7). In Turkey, 24.6% (6.143 million people) of the labor force are employed in the agriculture sector (8). Agriculture is one of the three most hazardous sectors in the world (the

other being mining and construction) (7). According to WHO data, living in or travelling to regions with endemic hepatitis B are considered as risk factors for HBV (9). The female farmworkers' settlements and living conditions are unhealthy; these women and their families live in crowded conditions and poverty, with poor hygienic conditions, under poor sanitation, and limited healthcare services. The farmworkers' risk of contracting hepatitis B is unknown in the Southeastern Anatolia Project (GAP) region. It is required to investigate the prevalence and risk factors affecting hepatitis B infection in this undeserved people. Although the majority of previous studies on the frequency of HBV have analyzed data obtained from blood donors, pregnant women, and medical personnel (10, 11), there are limited studies on reproductive-age female farmworkers. It is important to study these women with hepatitis B, because their newborn children are a potential risk group.

2. Objectives

The objective of this cross-sectional study was to determine the prevalence and risk factors of HBV markers among reproductive-age female farmworkers in the GAP region, in order to address future prevention and control activities.

3. Materials and Methods

3.1. Study Area

This study was conducted between January and April 2013, in the nine GAP provinces (Adıyaman, Batman, Diyarbakır, Gaziantep, Kilis, Mardin, Siirt, Sanliurfa, and Sırnak). According to the 2012 census records, the total population of the GAP region was approximately 7816173 (nearly one-tenth of the total Turkish population), where 25% of the population were employed in agriculture and 49.5% of the agriculture workers were women (12). The GAP region is one of the least developed regions of Turkey.

3.2. Study Design

In this study, hepatitis B variables from the representative multipurpose cross-sectional research data of the GAP Agricultural Health Survey/2013, conducted by the authors in collaboration with the Harran University Scientific Research Council and GAP Regional Development Administration, were analyzed. This survey was approved by the Ethics Committee of the Faculty of Medicine at Harran University. The sample size was calculated at 1200 households (95% confidence level, 5% confidence interval [CI] with design effect of 1.2) using probability proportional to size method by The National Turkish Statistics Institution. The cluster size was determined as ten households working in agriculture. The houses were numbered from one to ten; households were chosen by using a table of random digits. One woman aged 15 to 49

years old, who was able to provide informed consent and was eager to give blood sample, was chosen randomly in each house by person selection method. We excluded the women who had intellectual disabilities. Working in agriculture and animal husbandry was determined in 1128 households. A total of 137 women (12.1%) were reluctant to participate in the study or refused to a give blood sample, 41 of which (3.6%) could not be located during home visits, and there was no appropriate person to interview in seven households (0.6%). Therefore, this study was successfully conducted in 705 households with the response rate of 75%. During home visits, the aim of the study was explained to the participants and informed consent was obtained from each participant. Data were collected during a face-to-face interview using a structured questionnaire that included sociodemographic information on family size, age, education level, type of work (seasonal migratory worker vs. family farmer), type of settlement, number of pregnancies (parity), and delivery.

3.3. Blood Samples and Serologic Markers

Blood samples were drawn from female farmworkers aged between 15 and 49 years and kept in gel vacuum tubes. The tubes containing the blood were labeled and transferred to the Harran University Microbiology Laboratory under suitable conditions. The samples were centrifuged and stored at -80℃ until further use. The sera were tested for HBsAg, hepatitis B surface antibodies (anti-HBs), hepatitis B core antibodies (anti-HBc), and antibodies against hepatitis B e antigen (anti-HBe) using the enzyme-linked immunosorbent assay (Abbott Architect, Abbott Laboratories, IN, USA). We tested each control for these tests once in every 24 hours and paid attention for control values to be within the ranges specified in the control package insert. We calibrated the device according to the manufacturer's instructions for HBsAg, anti-HBs, anti-HBc, and anti-HBe. The ARCHITECT qualitative serological assay (HBsAg, anti-HBs, anti-HBc, and anti-HBe) calculated a result based on s ample relative light unit (RLU)/Cutoff RLU (S/CO). Specimens with S/CO values < 1.00 were considered nonreactive for HBs, anti-HBc, and anti-HBe assays and did not need undergoing further test. Specimens with S/CO values ≥ 1.00 were considered reactive for HBs, anti-HBc, and anti-HBe assays. Specimens with concentration values < 10.00 mIU/mL were considered nonreactive and ≥ 10.00 mIU/mL as reactive for anti-HBs. The diagnosis of hepatitis B is confirmed by demonstration of specific antigens and/or antibodies in the sera. The presence of HBsAg indicates that the person is potentially infected (4, 13, 14). Anti-HBs generally persists for a patients' lifetime in over 80% of cases and indicates immunity (4, 13, 14). Anti-HBc is the first antibody to appear. Demonstration of anti-HBc in the serum indicates current or previous HBV infection. Anti-HBe appears after anti-HBc and its presence correlates with a decreased infectivity. Anti-HBe replaces HBeAg in the resolution of the disease (4, 13, 14).

3.4. Statistical Analysis

Data entry and analyses were performed using SPSS 11.5 (SPSS Inc., Chicago, IL. USA). After determining the association factors in a bivariate analysis, logistic regression was used to control the confounder and to calculate adjusted odds ratios (OR) (95% CI). All of the statistical tests were two-tailed and differences were considered significant at P value < 0.05.

4. Results

A total of 705 reproductive-age female farmworkers, with a mean age of 36.16 ± 9.79 years and a mean household size of 8.12 ± 0.12, were enrolled in this study. Approximately, 64% of the participants had seven or more family members, 54.5% were > 35 years old, 68.1% were illiterate, 34.8% were seasonal migratory farmworkers, 58.4% had ≥ 5 children, and 61.2% had given a birth without the aid of healthcare professionals. The prevalence rates of the HBsAg, anti-HBs, anti-HBc, anti-HBe, and seropositivity were 5.7%, 25.9%, 28.9%, 16.4%, and 36.7%, respectively (Table 1). Anti-HBc and anti-HBe were detected in 32 and 30 HBsAg seropositive females (80% and 75%, respectively).

As seen in Table 2, while there was no significant association between HBsAg positivity and the size of the household, age group, education level, number of pregnancies, and place of birth (P > 0.05). Type of work and settlement were significantly associated with HBsAg positivity. HBsAg positivity was determined as 11% among migratory seasonal female farmworkers and 2.8% among female family farmworkers. According to logistic regression analyses (Table 3), HBsAg positivity was 4.2 times higher among seasonal female farmworkers than among female family farmworkers (95% Cl, 2.1-8.2); HBsAg seropositivity was also higher among women living slums of the urban area than among those living in rural areas (OR = 2.0; 95% Cl, 1.04-3.95).

Table 1. Prevalence Rates of the Seropositivity for Hepatitis B Virus Markers in the Southeastern Anatolia Project Region of Turkey, in 2013

Variables	No. (%)
HBsAg Positivity	40 (5.7)
Anti-HBs Positivity	182 (25.9)
Anti-HBc Positivity	204 (28.9)
Anti-HBe Positivity	116 (16.4)
Seropositivity	176 (25.1)
HBsAg Positivity Total	40 (100)
Anti-HBc Positivity in Cases With HBsAg Positivity	32 (80)
Anti-HBe Positivity in Cases With HBsAg Positivity	30 (75)

Table 2. HBsAg Positivity According to Selected Independent Variables [a]

Variables	HBsAg (+)	HBsAg (-)	Total	X²; P; Crude Odds Ratio (95% Cl)
Household Size				
≤ 6	16 (6.4)	235 (93.6)	251 (35.6)	0.157; 0.69; 1.1 (0.6-2.2)
≥ 7	24 (5.3)	430 (94.7)	454 (64.4)	
Age Groups				
≤ 34 y	17 (5.3)	304 (94.7)	321 (45.5)	0.157; 0.69; 1.1 (0.6-2.2)
≥ 35 y	23 (6.0)	361 (94.0)	384 (54.5)	
Education Level				
Illiterate	26 (5.6)	445 (94.5)	471 (68.1)	0.18; 0.67; 1.2 (0.6-2.3)
Primary School or Higher	14 (6.4)	206 (93.6)	220 (31.9)	
Type of Work				
Family Farmers	13 (2.8)	447 (97.2)	460 (65.2)	20.05; 0.00; 4.3 (2.2-8.4)
Seasonal Migratory Workers	27 (11.0)	218 (89.0)	245 (34.8)	
Type of Settlement				
Rural Area	15 (3.9)	373 (96.1)	388 (55.0)	5.26; 0.022; 2.0 (1.1-3.8)
Slum in Urban Area	25 (7.9)	292 (92.1)	317 (45.0)	
Number of Pregnancies (Parity)				
≤ 4	13(4.4)	280 (95.6)	293 (41.6)	1.43; 0.15; 1.5 (0.8-2.9)
≥ 5	27 (6.6)	385 (93.4)	411 (58.4)	
Place of Delivery				
Birth at a Healthcare Center	13 (5.0)	246 (95.0)	259 (38.8)	0.71; 0.40; 1.32 (0.70-2.50)
Birth at Home Without Health Professionals Aid	27 (6.6)	382 (93.4)	409 (61.2)	
Total	40 (5.7)	665 (94.3)	705 (100.0)	

[a] Data are presented as No. (%).

Table 3. Result of Logistic Regression (Risk Factors for HBsAg Positivity) [a]

Independent Variables	B	SE	Wald	P Value	EX (B)	CI 95%	
						Lower	Upper
Type of Work (Seasonal Farmworkers)	1.424	0.349	16.684	0.000	4.15	2.08	8.23
Type of Settlement (Living in Slums)	0.707	0.340	4.320	0.038	2.029	1.04	3.95
Constant	-3.902	0.348	126.038	0.000			

[a] Abbreviations: B: This is the coefficient for the constant (also called the "intercept") in the null model; S.E: These are the standard errors associated with the coefficients Wald and Sig: These columns provide the Wald chi-square value and 2-tailed P value used in testing the null hypothesis that the coefficient (parameter) is 0, Exp (B): The odds ratio for an independent variable.

Table 4. Anti-HBs Positivity According to Selected Independent Variables [a]

Variables	Anti-HBs (+)	Anti-HBsAg (-)	Total	X^2; P; Crude Odds Ratio (95% CI)
Household size				
≤ 6	68 (27.1)		251 (35 6)	0.313; 0.57; 1.01 (0.8-1.3
≥ 7	114 (25.2)		454 (64 4)	
Age Groups				
≤ 34 y	68 (21.3)	253 (78.7)	321 (45.5)	6.48; 0.011; 1.6 (1.1-2.2)
≥ 35 y	114 (29.7)	270 (70.3)	384 (54.5)	
Education Level				
Illiterate	132 (28.2)	338 (71.8)	471 (68.1)	2.76; 0.096; 0.7 (0.5-1.1)
Primary School or Higher	49 (22.3	171 (77.7)	220 (31.9)	
Type of Work				
Family Farmers	113 (24.6)	347 (75.4)	460 (65.2)	1.14; 0.28; 1.2 (0.9-1.7)
Seasonal Migratory Workers	69 (28.3)	175 (71.7)	245 (34.8)	
Type of Settlement				
Rural Area	97 (25.1)	290 (74.9)	388 (55.0)	0.27; 0.59; 0.9 (0.7-1.3)
Slum in Urban Area	85 (26.8)	232 (73.2)	317 (45.0)	
Number of Pregnancies (Parity)				
≤ 4	61 (20.8)	232 (79.2)	293 (41.6)	6.63; 0.010; 1.6 (1.1-2.3)
≥ 5	121 (29.4)	290 (70.6)	411 (58.4)	
Place of Delivery				
Birth at a Healthcare Center	50 (19.3)	209 (80.7)	259 (38.8)	8.145; 0.004; 1.7 (1.2-2.6)
Birth at Home Without Healthcare Professionals Aid	119 (29.2)	289 (70.8)	409 (61.2)	
Total	182 (25.9)	523 (74.1)	705 (100.0)	

[a] Data are presented as No. (%).

As seen in Table 4, the bivariate analyses revealed significant associations between anti-HBs positivity and age, parity, and place of delivery (P < 0.05). There were no significant association between anti-HBs positivity and the size of household, education level, type of work, and type of settlement (P > 0.05).

Multivariate logistic regression models showed that woman with older age (OR = 1.4; 95% CI, 1.02-2), high

Table 5. Result of Logistic Regression (Risk Factors for Anti-HBs Positivity) [a]

Independent Variables	B	SE	Wald	P Value	EX, (B)	CI 95%	
						Lower	Upper
Women's Age (≥ 35 y)	0.291	0.222	3.024	0.025	1.38	1.02	2.07
Number of Pregnancies (≥ 5)	0.200	0.233	3.957	0.047	1.22	1.02	1.93
Place of Delivery (Birth at Home Without Healthcare Professionals Aid)	0.353	0.213	4.531	0.003	1.42	1.03	2.16
Constant	-3.902	0.348	126.038	0.000			

[a] Abbreviations: B, B : This is the coefficient for the constant (also called the "intercept") in the null model; SE, These are the standard errors associated with the coefficients; and EX,): The odds ratio for an independent variable.

parity (OR = 1.2; 95% CI, 1.02-1.9), and delivery at home without healthcare professionals aid (OR = 1.4; 95% CI, 1.03-2.2) were more likely to have high anti-HBs levels (Table 5).

5. Discussion

To our knowledge, this study was the first to report the prevalence on representative reproductive-age female farmworkers, which aimed to estimate the at risk group in agricultural communities. The number of findings is highlighted by the Sanliurfa study. The prevalence of HBsAg positivity was 5.7% among agricultural reproductive-age female farmworkers. Similar result were reported in a study (4.2%) (15), while it was twice higher when compared to another study conducted in Turkey (11). In our study, anti-HBs positivity was determined in approximately one out of every four female farmworkers of childbearing age with a high prevalence of 25.9%. Other serologic markers prevalence rates for anti-HBc total positivity, anti-HBe positivity, and seropositivity were 28.9%, 16.4%, and 36.7%, respectively. The findings of the present study indicated that the rate of anti-HBc positivity was higher than those of a previous study in Turkey (16). Moreover, anti-HBc was detected in 80% and anti-HBe in 75% of cases with HBsAg positivity. These findings were similar to those of population-based studies conducted in other regions of Turkey (17). On the other hand, the rates of HBsAg and anti-HBs positivity in this study were three times higher than those in studies on pregnant women in different Muslim countries and Southeastern Anatolia (18-20). In this study, the prevalence of hepatitis B was higher than that of a study reporting a prevalence rate of 1.3% in the general population of Central Iran (21). This difference might be due to the living conditions related to the occupation. Thus, our study might appear in line with the estimate that considered Turkey as a country with intermediate endemicity for hepatitis B. Horizontal transmission was an important risk factor, particularly among farmworkers with a low socioeconomic status. In our study, 64.9% of the female farmworkers' families had at least seven members. We observed that the study areas in which female farmworkers live in represent the same features as other developing countries, ie, low socioeconomic status, poor hygiene, and crowded households, where hepatitis B is endemic. Moreover, families living

in overcrowded conditions and those far from the health services might be at a higher risk of hepatitis B infection (3, 10, 11, 22). According to the age-specific prevalence of HBsAg positivity, we found the lowest prevalence in the age group of 15 to 24 years (4.5%), which might be the result of a national vaccination program for the prevention of perinatal transmission of hepatitis B infection, launched in Turkey in 1998 by the Turkish Ministry of Health (23). In our study, seasonal female farmworkers were the major at-risk group for HBsAg positivity. The rate of hepatitis B infection was 4.2-times higher in seasonal farmworkers than in female family farmworkers. This might be explained by the obstacles to access healthcare services, unhealthy and substandard living conditions, and movement from one place to another.

In our study, the type of settlement was another significant risk factor for HBsAg positivity. Female farmworkers living in urban slum areas had a higher infection rate of hepatitis B than female farmworkers living in villages did. This might be related to the underserved population in slums and their exposure to unhealthy conditions. In this study, other risk factors included higher parity and the place of delivery for female farmworkers. Women with ≥ 5 pregnancies who did not receive healthcare professionals' aid were more often infected with hepatitis B. This might be related to the limited access to healthcare services, using unhealthy and contaminated devices, and traditional methods during birth.

In our study, educational attainment was not associated with hepatitis B, which might be due to the distribution of the female farmworkers' education levels. In our study, 68.1% of the female farmworkers were illiterate and others attended only primary school or higher. Thus, there was no significance difference according to educational levels. We noticed that primary school was not enough for changing the attitude for preventing, controlling, and raising awareness about hepatitis B as a source of infection.

5.1. Strengths and Limitations

The results of the present study should be interpreted in the light of a number of limitations. First, as this study involved a cross-sectional household interview survey, it might be impossible to draw conclusions about the na-

ture of the putative causal relationship between hepatitis B and independent variables. Despite this limitation, the present study identified the prevalence and at-risk groups in reproductive-age women farmworkers, according to WHO recommendations to control the disease. Older age, seasonal migratory farmworker, high parity, living in slums, and delivery at home or field without health professional assistance were risk factors of contracting HBV infection. Despite the limitation in the design of this study, the results of this study had immediate practical implications for improvement of the Hepatitis B control.

Secondly, additional analytic-epidemiologic researches are needed to replicate these findings and to investigate the potential underlying mechanisms that could explain the differential association of HBV infection and risk factors. The high prevalence rate highlighted by this study reflects a profound primary healthcare services gap. There is an urgent need for the development of integrated interventions to reduce risk factors as well as to strengthen protective factors to control hepatitis B infection. These recommended systematic and institutional steps are needed to control of the disease:

1) enhanced surveillance systems to gather and analyze data for the identification and monitoring of risk groups; 2) intersectoral approaches to reduce health inequalities and living conditions; 3) undergraduate medical education and in-service training for primary healthcare staff to provide better health services in the agricultural population, specifically targeting seasonal female farmworkers of between 15 and 49 years of age; and 4) the healthcare system should follow up with all female farmworkers in the fields and primary care activities should be provided by mobile health services, including laboratory analyzing support, screening, vaccination, and health education programs (24). All of these domains would be of vital importance for prevention and intervention measures in control of hepatitis B.

Acknowledgements

Authors' Contributions

Study concept and design: Nebiye Yentur Doni and Zeynep Simsek; acquisition of data: Nebiye Yentur Doni, Zeynep Simsek, Zehra Keklik, and Gulcan Gurses; analysis and interpretation of data: Zeynep Simsek and Nebiye Yentur Doni; drafting the manuscript: Zeynep Simsek, Nebiye Yentur Doni, Zehra Keklik, Gulcan Gurses, and Fadile Yildiz Zeyrek; critical revision of the manuscript for important intellectual content: Nebiye Yentur Doni, Zeynep Simsek, and Fadile Yildiz Zeyrek; statistical analysis: Nebiye Yentur Doni and Zeynep Simsek; Administrative, technical, and material support: Nebiye Yentur Doni, Zeynep Simsek, Zehra Keklik, Gulcan Gurses, and Fadile Yildiz Zeyrek; and study supervision: Nebiye Yentur Doni, Zeynep Simsek, Zehra Keklik, Gulcan Gurses, and Fadile Yildiz Zeyrek.

Funding/Support

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