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ORIGINAL ARTICLE

PREVALENCE AND ASSOCIATED RISK FACTORS OF HEPATITIS B AND C VIRUS INFECTIONS AMONG MOTHERS IN JIMMA, SOUTH WEST ETHIOPIA: A COMMUNITY-BASED STUDY

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ABSTRACT

Background: *Viral hepatitis affects over 400 million people globally with 6 to 10 million people newly infected each year. Viral hepatitis infectious agents such as hepatitis B virus (HBV) and hepatitis C virus (HCV) are among the greatest threats to the liver and can cause liver cancer. One of the most important modes of transmission of these viruses is a vertical transmission from mother to child. The aim of this study is to assess the prevalence of HBV and HCV infection as well as its associated risk factors among mothers in Jimma.*

Methods: *A community-based cross-sectional study was conducted among 455 mothers in Jimma from June to December 2016. Simple random sampling was employed to recruit study participants and informed consent was obtained. From each mother, about 5ml of blood was collected and tested for HBsAg, anti-HBc, and HCVAg/Ab using ELISA. Chi-square and logistic regression tests were used to assess statistically significant associations between dependent and independent variables. P-values less than 0.05 were considered statistically significant.*

Result: *HBsAg, anti-HBc and HCVAg/Ab prevalence was 5.7%, 30.5% and 2.5%, respectively. Multivariate logistic regression analysis showed that history of hospital admission (AOR = 3.098; P <0.040) and abortion (AOR = 15.514, P <0.001) remained independent predictors of HBsAg seropositivity.*

Conclusion: *Hospital admission and abortion are the major risk factors for hepatitis B and C virus infection among mothers. Awareness creation for adult HBV vaccine and health education on modes of transmission should be promoted and strengthened.*

Keywords*: Hepatitis viruses, seroprevalence, community-based, Ethiopia.*

INTRODUCTION

Viral hepatitis affects over 400 million people globally with 6 to 10 million people newly infected each year. Hepatitis is characterized by inflammation and necrosis of the liver and may result from infection with a variety of viruses (1,2). All hepatitis viruses (A, B, C, D and E) can cause acute hepatitis, but only hepatitis B virus (HBV) and hepatitis C virus (HCV) are major causes of chronic hepatitis, cirrhosis, and liver cancer globally (1). Patients with HBV and/or HCV infection have greater risk for severe liver disease outcomes when acquired early in life and remain infectious to others (3-5). Pregnant women are vulnerable to HBV and if infected, they can transmit the infection to their sexual partners, their children, and health care workers during delivery (5).

On the other hand, more than 80% of HCV exposed individuals become chronic carriers and 30% of them develop chronic liver disease (6).

The risk factors for the transmission of HBV and HCV infection vary among different countries (1, 5, 7). Major risk factors for transmission in pregnant women and women of childbearing age include a history of blood transfusion, surgery, abortion, sexually transmitted infections, level of education, higher mean parity, early sexual debut, tattooing, polygamy, and higher numbers of sexual partners (5,7-9).

Both HBV and HCV are widely prevalent in Ethiopia and result in serious complications (10-12). The prevalence of hepatitis B infection varies with geographic and socioeconomic differences in the population ranging from 5.7 to 10.9% (13–15).

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HBV infection prevalence in pregnant women is estimated to be around 3.7% (16), whereas the prevalence of HCV in pregnant women ranges from 0.5 to 8.5% (17). Most of the previous studies in Ethiopia focused mainly on blood donors and pregnant women at health facilities, which may underestimate or exaggerate the actual prevalence. Furthermore, most studies on seroprevalence of HBV infection depend either on rapid test kits or ELISA method to capture HBsAg markers (11-17). In this study, anti-HBc levels determined using ELISA are used as a marker to identify mothers exposed to the virus in the past but test negative for HBsAg marker. Overall, this community-based cross-sectional study was conducted to determine the magnitude of HBV and HCV infections and associated risk factors among mothers in Jimma, southwest Ethiopia.

PATIENTS AND METHODS

Study setting, design, and period: The study was done in Jimma, which is located in the Oromia regional state, 352 kilometers from Addis Ababa, Southwestern Ethiopia. According to information obtained from the city health department in April 2016, the total population was estimated to be 194,140 with 98,907 male and 95,233 female inhabitants.

A community-based cross-sectional study was carried out from June to December 2016. Mothers with children aged between 5 - 9 years who had lived for at least six months in the study area were included from each sampled household after informed consent was obtained. This age range was selected based on the roll-out of the Ethiopia introduced hepatitis B virus vaccine (pentavalent vaccine currently on administration) since 2007.

Sample size determination and sampling procedure: The standard single population proportion formula were used to calculate the final sample size by adding a 15% non-response rate. With ninety-five percent confidence level, national seroprevalence of HBV and HCV in Ethiopia were used to derive mean sample size (11,15). A total of 455 mothers were recruited through proportional allocation to all 17 Kebeles (the smallest administrative unit) of Jimma. A simple random sampling technique was employed to identify the first household (sample) in each Kebele and subsequent households were selected using systematic sampling.

Sociodemographic, clinical, and laboratory data: A house-to-house survey was conducted by health extension workers of each Kebele and a face-to-face interview was conducted by trained nurses to collect sociodemographic and clinical data. About 5 milliliters (ml) of blood sample was collected aseptically from each study participant. All blood specimens from each Kebele were transported to Jimma University Microbiology laboratory on the same day in a cold box system (at 4^0C). Blood samples were labeled and processed to separate serum. Then the sera were stored at -80^0C (Thermo Fisher Scientific, USA) until the actual serologic analysis was conducted.

Serological assay: A detailed laboratory protocol was followed based on the manufacturer's instructions. All of the sera samples were tested using commercially available Enzyme Linked immunosorbent assay (ELISA) test kits for HBsAg (Bio-Rad kit, Monolisa™, HBsAg ULTRA, La Coquette, France), Anti-HBc (Bio-Rad kit, Monolisa™, Anti-HBc PLUS, La Coquette, France), and HCV Ag/Ab (Bio-Rad kit, Monolisa™, HCV Ag/Ab PLUS, La coquette, France).

Quality control: Different quality control activities were followed to ensure the quality of data, including pre-testing of questionnaires, standardization of procedures, training of data collectors, and periodic supervision. ELISA kits were checked for appropriate storage conditions and expiry date. Internal positive and negative controls were included in each assay. Further, standard operation procedures (SOPs) and manufacturer instructions were strictly followed during specimen collection, storage, and laboratory procedures. Some inconsistent findings were checked and retested for ELISA.

Data management and statistical analysis: Completed questionnaires were double entered into Epi-Data version 3.1, checked for consistency and accuracy, and finally exported to SPSS version 20 software package for analysis. Chi-square and logistic regression tests were used to assess for statistically significant association between dependent and independent variables. P-values less than 0.05 were considered a statistically significant.

Ethical considerations: Ethical approval was obtained from the Institutional Review Board (IRB), College of Health Sciences, Jimma University and the Armauer Hansen Research Institute (AHRI/ ALERT) Ethics Review Committee. Permission to conduct the study was secured from Jimma Health

Written informed consent was obtained from each mother who participated in this study. Study participants that were seropositive for HBV or HCV markers were linked with a health facility for care and support.

RESULTS

Sociodemographic characteristics of study participants: A total of 455 mothers were recruited to this study. The median age of the mothers was 28 years. Around 87% (385/455) of the study participants were living in urban Kebeles and 49.0% were illiterate. The majority of mothers were housewives and earned less than a thousand Ethiopian Birr per month (Table 1).

Table1: Sociodemographic characteristics of study participants.

	Category	Number	Percentage
Age (years)	20-24	41	9.0
	25-29	207	45.5
	30-34	115	25.3
	35-39	52	11.4
	≥ 40	40	8.8
Residence	Urban	395	86.8
	Rural	60	13.2
Marital status	Single	2	0.4
	Married	410	90.1
	Widowed	17	3.7
	Divorced	26	5.7
Education status	Illiterate	223	49.0
	Primary (1-8)	166	36.5
	Secondary and above	66	14.5
Occupation	Employed	21	4.6
	House wife	417	91.6
	Daily laborer	12	2.6
	Self-employee	5	1.1
Income (ETB) #	≤1000	310	68.1
	1001-2000	136	29.9
	2001- 3000	7	1.5
	>3000	2	0.4
Parity	One	74	16.3
	Two	149	32.7
	Three	97	21.3
	Four and above	135	29.7

[#] ETB: Ethiopian Birr

Prevalence of HBsAg and Anti-HBc: The overall prevalence of HBsAg among all study participants was 5.7% (26/455) while the prevalence of HBc antibody was 30.5% (139/455). Among 26 HBsAg positive women, 23 of them were urban dwellers and 17 of them were 25-30 years old. The prevalence of HBsAg was higher among uneducated mothers (9.4%) than in those above primary educational levels (1.8%) (c^2 = 21.292 df 6, P-value =0.020). HBsAg positivity was also significantly higher in daily laborers.

Anti-HBc prevalence was higher in mothers ≥45 years old (71.4%) and increased with age. Sociodemographic variables such as residence, marital status, education level, occupation, and monthly income were not significantly associated with anti-HBc prevalence as shown in Table 2.

Table 2: Prevalence of HBsAg and Anti-HBc segregated by socio-demographic characteristics.

Socio-demographic variable	Category	HBsAg (-ve) £ % (N)	HBsAg (+ve)$ %(N)	HBsAg Total N	P value	Anti-HBc (-ve) % (N)	Anti-HBc (+ve) %(N)	Anti-HBc Total N	P value
Residence	Urban	372	5.8(23)	395	0.79	276	30.1(119)	395	0.61
	Rural	57	5.0(3)	60		40	33.3(20)	60	
Age (years)	20-24	40	2.4(1)	41		32	22.0(9)	41	
	25-29	90	8.2(17)	207		153	26.1(54)	207	
	30-34	110	4.3(5)	115	0.30	75	34.8(40)	115	0.043
	35-39	49	5.8(3)	52		34	34.6(18)	52	
	40-44	33	0.0(0)	33		20	39.4(13)	33	
	≥45	7	0.0(0)	7		2	71.4(5)	7	
Marital status	Single	2	0.0 (0)	2		2	0.0(0)	2	
	Married	386	5.9(24)	410	0.95	290	29.3(120)	410	0.16
	Widowed	16	5.9(1)	26		9	47.1(8)	17	
	Divorced	25	3.0(1)	26		15	42.(11)	26	
Education level	Illiterate	24	8.5(199)	223		153	31.4(70)	223	
	Primary(1-6)	114	29.2(5)	119		83	30.2(36)	119	
	Secondary/preparatory	95	10.0(1)	96	0.02	67	31.2(30)	96	0.33
	Diploma and above	16	5.9(1)	17		13	23.5(4)	17	
Mothers Occupation	Employed (GO/NGO)	20	4.8(1)	21		14	33.3(7)	21	
	House wife	395	5.3(22)	417	0.032	292	30.0(125)	417	0.468
	Daily laborer	9	25.0(3)	12		6	50.0(6)	12	
	Self-employee	5	0.0(0)	5		4	20.0(1)	5	
Monthly income	<1000	293	5.5(17)	310		213	31.3(97)	310	
	1001-2000	127	6.6(9)	136	0.854	96	29.4(40)	136	0.788
	2001-3000	7	0.0(0)	7		5	28.6(2)	7	
	>3000	2	0.0(0)	2		2	0.0(0)	2	
Parity	One	70	5.4(4)	74		57	23.0(17)	74	
	Two	143	4.0(6)	149	0.579	108	27.5(41)	149	0.184
	Three	89	8.2(8)	97		62	36.1(35)	97	
	4 & more	127	5.9(8)	135		89	34.1(46)	135	

£-Negative results for the tested trait; $- Positive results for the tested trait

Prevalence of HBsAg showed significant association with home delivery, abortion, sharing of toothbrush, surgical and traditional dental procedure, and hospital admission. On the other hand, only sharing of toothbrush and exposure to a surgical procedure was significantly associated with anti-HBc prevalence as shown in Table 3.

***Prevalence of HCV*:** The overall prevalence of HCV infection was 2.5% (9/362). HCV infection was more common in mothers that were older than 45 years of age. Other sociodemographic characteristics such as residence, marital status, occupation, education status and parity were not significantly associated with HCV infection.

Table 3: Prevalence of HBsAg and Anti-HBc segregated by cultural practice and clinical variables.

Cultural/ clinical. variable	Category	HBsAg				Anti-HBc			
		Negative N	Positive %/N	Total N	P value	Negative N	Positive %/ N	Total N	P value
Ear/nose/body piercing	No	2	0.0(0)	2	0.72	1	50.0(1)	2	0.55
	Yes	427	5.7(26)	453		315	30.5(138)	453	
Current pregnancy	No	373	6.0(24)	397	0.42	272	125(31.5)	397	0.25
	Yes	56	3.4(2)	58		44	14(24.1)	58	
Home delivery	Yes	258	8.2(23)	281	0.004	195	30.6(86)	281	0.97
	No	171	1.7(3)	174		121	30.5(53)	174	
Abortion	No	415	3.7(16)	431	<0.001	301	30.5(130)	431	0.44
	Yes	14	41.7 (10)	24		15	37.5(9)	24	
Awareness to hepatitis infection	No	404	5.8(25)	429	0.673	298	30.5(131)	429	0.980
	Yes	25	3.8(1)	26		18	30.8(8)	26	
Sharing tooth brush and grooming items	No	419	4.3(19)	438	< 0.001	312	28.8(126)	438	< 0.001
	Yes	10	41.2(7)	17		4	76.5(13)	17	
Surgical procedure	No	399	4.8(20)	419	0.003	297	29.1(22)	419	0.024
	Yes	30	16.7(6)	36		19	47.2(17)	36	
Blood transfusion	No	422	5.8(26)	448	0.512	312	30.4(136)	448	0.476
	Yes	7	.0(0)	7		4	42.9(3)	7	
Dental procedure by TPa	No	426	5.324	450	0.001	314	30.2(136)	450	0.151
	Yes	3	40.0(2)	5		2	60.0(3)	5	
Hospital admission	No	336	3.2(11)	347	<0.001	247	28.8(100)	347	0.151
	Yes	93	13.9 (15)	108		69	36.1(39)	108	
HIV status	Negative	320	5.9(20)	340	0.624	239	29.7(101)	340	0.798
	Positive	15	0(0)	15		10	33.3(5)	15	
	Unknown	94	6.0(6)	100		67	33.0(33)	100	

[a] = TP: traditional practitioner

Bivariate analyses of HBsAg status and HCV infection: Different risk factors of study participants which might have association with prevalence of HBV and HCV infections were analyzed. In bivariate analysis, some of the independent variables such as history of home delivery (OR 5.081; p = 0.009), surgery (OR 3.990; p = 0.006), sharing of toothbrush (OR 15.437; p < 0.001), and dental procedures by traditional practitioner (OR 11.833; p = 0.008) were significantly associated with hepatitis surface antigen (HBsAg) positivity.

History of hospital admission (OR 4.927; p = 0.044) and blood transfusion (OR 10.906; p =0.042) were significantly associated with HCV infection as shown in Table 4.

Table 4: Bivariate logistic regression analysis of HBsAg or HCV prevalence and significant predictor variables.

Variables	Category	OR for HBsAg	P-value	OR for HCV	P-value
Home delivery	No	1	0.009	1	0.093
	Yes	5.081		5.980	
Surgery	No	1	0.006	1	0.730
	Yes	3.990		1.451	
Hospital admission	No	1	< 0.001	1	0.044
	Yes	4.927		3.941	
Sharing tooth brush	No	1	<0.001	1	0.189
	Yes	15.437		4.287	
Dental procedures by TPa	No	1	0.008	1	0.999
	Yes	11.833		0.000	
Abortion	No	1	< 0.001	1	0.062
	Yes	18.527		4.757	
Blood transfusion	No	1	0.999	1	0.042
	Yes	0.000		10.906	

[a] = TP: traditional practitioner

Multivariate analyses of HBs Ag status and HCV infection: After adjusting for potential confounding effects in the multivariate logistic regression analysis, only hospital admission and abortion remained independent predictors of HBsAg seropositivity.

On other hand none of the predictors, which showed association in separate analyses, remained independent predictors for HCV infection (Table 5).

Table 5: Multivariate logistic regression analysis of HBsAg or HCV prevalence and some significant predictor variables.

Variables	Category	AOR HBs Ag	95% CI for AOR		P-value	AOR HCV	95% CI for AOR		P-value
			Lower	Upper			Lower	Upper	
Home delivery	No	1			0.081				0.130
	Yes	3.136	0.868	11.333		5.146	0.618	42.877	
Hospital admission	No	1			0.040				0.097
	Yes	3.098	1.056	9.088		3.268	0.808	13.218	
Abortion	No	1			<0.001				0.272
	Yes	15.514	4.487	53.636		2.714	0.458	16.095	
Blood transfusion	No								0.151
	Yes					5.934	0.522	67.436	

DISCUSSION

The present study is the first community-based cross-sectional study to determine the magnitude of HBV and HCV infections among mothers in Jimma town. The overall prevalence of HBsAg was 5.7%. The finding of this study may be higher than what was found in studies from Addis Ababa (21), Felege Hiwot Referral Hospital (22), and Gojjam zones (23). This could be explained by the fact that participants in the other studies were pregnant women admitted in health facilities (21,22) or all the participants were adults (23). The prevalence of HBV in our study is lower than the prevalence reported in studies from Jijiga in Eastern Ethiopia (24), Southern Ethiopia (25) and Wolaita Sodo (17).

The detection of the hepatitis B core antibody indicates exposure to the virus in the past. Anti HBc antibodies appear at the onset of acute infection and can persist for life. Moreover, their presence indicates ongoing infection with the virus even if HBs antigen is absent from the blood system. In this case, molecular methods are required to detect HBV DNA (4). This study revealed that the prevalence of anti-HBc was 30.5% among our study participants. Although similar study design and study populations were not used, comparable results have been reported from Addis Ababa (31.7%) (25) and southern Ethiopia (39.4%) (26). On the other hand, higher anti-HBc positivity was reported from other countries such as China (47.4%) (27). This discrepancy could be due to the difference in the study participants and geographic location.

In the present study, HCV Ag/Ab positivity was 2.5% (9/352) among all study subjects and 4 of the nine mothers were also positive for anti-HBc. This finding is comparable with findings from previous studies conducted in Addis Ababa (21) and North India (28). However, it may be higher than findings reported in Gondar, Ethiopia, Bahir Dar, Ethiopia, and Lorestan, West of Iran (15,23,29). Lower values than our findings were reported in studies from South-East Iran (25), Benin (30), Yemen (31), Burkina Faso (32), and Nigeria (33).

According to Polaris Observatory collaborators on HCV (34), the global prevalence of HCV is estimated to be 1·0% (95% uncertainty interval 0·8–1·1) in 2015. In this global review, Ethiopian burden of HCV viremic prevalence estimate is between 0.4 to 0.7%. Our finding of 2.5% HCV prevalence among mothers is more than fourfold higher than the global estimate. There may be local and regional differences in cultural practices that facilitate HCV transmission in the Jimma area. This finding calls for further investigation in larger population size.

Our study also revealed that HCV infection was more frequent in mothers older than 45 years of age ($p= 0.001$). This finding is comparable with the result reported from a previous study Ethiopia (35). In this study, a statistically significant association was observed between some clinical factors (history of abortion, blood transfusion, and hospital admission) and HCV infection. This finding was consistent with previous reports from Ethiopia (35) and North India (28). Further studies can identify risk factors for transmissibility of HCV in addition to predicted clinical factors identified in this study.

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