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Prevalence of Hepatitis B Virus Infection and Associated Seromarkers among Pregnant Women in Eritrea

Abstract

Background: The global burden of chronic Hepatitis B infection is estimated at more than 240 million. Early HBV transmission and especially mother-to-child transmission (MTCT) contributes for more than one third of those chronic cases. Therefore understanding the epidemiology of HBV infection among pregnant women is critical to prevent MTCT. The epidemiology of HBV infection within the general population of many sub-Saharan African countries is documented but there is very limited data among pregnant women. In this study, the sero-prevalence of HBV markers was assessed among women seeking antenatal care within different health facilities in Eritrea.

Methods: This study was conducted within the framework of the 2016 national antenatal care (ANC) sentinel surveillance for HIV infection. A total of 5009 participants from a selected 16 ANC sites were screened for HBV Seromarkers. The Seromarkers screened using Enzyme Linked Immunosorbent Assay (ELISA) technique included; HBsAg, HBeAg, anti-HBe, anti-HBc and anti-HBs. The data generated by the serological testing were collated to the socio-demographic characteristic which was generated by use of questionnaires.

Results: The mean age of the women was 26.7 ±5.9 years. Results of the serological markers showed that 163 (3.2%) were positive for HBsAg indicating an active infection and 7(3.9%) positive for HBeAg indicating an increased infectivity. It was noted that 35 (17.4%) of the HBsAg positive women also presented with anti-HBe. The prevalence of anti-HBc and anti-HBs Seromarkers among the study participants was 1241 (25.8%) and 706 (14.2%) respectively. The prevalence of HBV showed marked difference among the zobas (regions) ranging from 2.1% to 7.5%. Results of the socio-demographic data showed that 92.7% of the women were married with 88.5% being housewives. Approximately 68% of the women had attended formal education.

Conclusion: The results of this study show a potential for vertical transmission within the 3.2% population determined. Childhood vaccination against HBV therefore remains key to prevention and mitigation of HBV in the Eritrean population.

Keywords: Hepatitis B virus; Seroprevalence; ELISA, Pregnant women; Antenatal care; Eritrea

Research Article

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Nahom Fessehaye[1]*, Araia Berhane[2], Hagos Ahmed[3], Salih Mohamed[4], Freweini Tecle[4], Joseph Gikunju[1] and Eddy Odari[1]

[1]*School of Biomedical Sciences, Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya*
[2]*Communicable Diseases Control Division, Ministry of Health, Asmara, Eritrea*
[3]*National Statistics Office, Asmara, Eritrea*
[4]*National Health Laboratory, Asmara, Eritrea*

***Corresponding author:** Nahom Fessehaye, School of Biomedical Sciences, Jomo Kenyatta University of Agriculture and Technology, Nairobi, Kenya, P.O. Box 62 0000-00200; Tel: +254-792639979; Email: abynabi27@gmail.com

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Abbreviations: 95%CI: 95% Confidence Interval; ANC: Antenatal Care Attendee; aOR: Adjusted Odds; Ratio; cOR: Crude Odds Ratio; HBV: Hepatitis B Virus; HBeAg: Hepatitis B e antigen; HBsAg: Hepatitis B Surface Antigen; Anti-HBc: Hepatitis B Core Antibody; Anti-HBe: Hepatitis Be Antibody; Anti-HB: Hepatitis B Surface Antibody; HIV: Human Immunodeficiency Virus; MoH: Ministry of Health; NHL: National Health Laboratory; WHO: World Health Organization.

Introduction

WHO estimates the burden of Hepatitis B virus (HBV) infection at 2 billion, with more than 240 million patients developing chronic infection [1]. Annually 686,000 patients die as a result of HBV-related liver complications such as cirrhosis and hepatic carcinoma 1. Almost one third of those who develop chronic HBV infections acquire the infection via vertical transmission or horizontally during early childhood [2]. A mathematical projection on the global burden of HBV for children born in the year 2000 estimated that without HBV vaccine in the course of their life time an estimated 64 million will develop HBV infection with 1.4 million dying due to HBV related complications [3]. Eritrea is geographically located in sub-Saharan Africa, a region considered endemic to HBV infection with an intermediate to high prevalence [1]. The epidemiology of HBV infection in Eritrea is not well documented and there are only limited studies conducted to explore the extent of the problem. A study conducted among blood donors reported an intermediate prevalence of HBsAg Seromarkers of 2.6% [4]. The available HBV prevalence data from the region shows a varied prevalence pattern among countries and within each country. In Ethiopia different studies have been conducted among pregnant women documenting an HBsAg prevalence ranging from 3.4-7.8% [5-9]. Similarly a study

done in Kenya had reported an overall HBsAg prevalence of 9.3% ranging from 3-17.8% for the different regions of the country [10]. Other neighboring geographical locations have reported HBsAg prevalence of 5.6%, 11% and 10.8% for Sudan [11], South Sudan [12] and Yemen [13]. Vertical transmission of HBV occurs primarily in infants born to HBsAg carrier mother or mother with acute hepatitis B during pregnancy or during the early postpartum period [14-16].

The risk of HBV transmission through the perinatal route depends on the presence of HBeAg in the blood of mothers infected with HBV [15,16]. Reports from the African continent have documented that children born to mothers seropositive for both HBsAg and HBeAg are thought to have a pooled risk of 38.3% getting the infection if not given appropriate immuno prophylaxis [17]. This is much higher when compared to the 4.8% reported among infants born to mothers who are HBsAg positive but HBeAg negative [17]. Moreover infants of HBsAg positive women who are not infected at birth are at increased risk of HBV infection during early childhood because of household contact [15]. Childhood immunization remains the most important preventative method as recommended by the WHO. Since 2009 the WHO recommended member states to introduce universal hepatitis B birth dose (HepB- BD) vaccination to prevent vertical transmission of HBV [15]. Even though most countries incorporated HBV vaccination in their national immunization program the introduction of HBV vaccine at birth is not yet implemented by most developing countries including Eritrea. HBV vaccine was introduced in Eritrea in 2002 as part of the national immunization program and is given at 6, 10 and 14 weeks of age.

Developing countries had to mitigate challenges posed by infectious diseases such as HBV by smartly utilizing the limited health resources. This requires informed decision making on the part of health policy makers and implementers. In this sense understanding the national and local epidemiology of HBV is important. The objective of this study was thus to determine the seroprevalence of HBV among pregnant women and assess the potential of perinatal HBV transmission in Eritrea.

Methods and Materials

Study site

This study was carried out in Eritrea, a country divided into six administrative regions (zobas) namely: Maekel, Debub, Anseba, Gash-Barka, Semenawi Keiyh Bahri, and Debubawi Keiyh Bahri. The country has an estimated population of approximately 5 million with about 53% being above the age of 15 years, the highest within this group, being women of 20-60 years of age [18]. The country's crude birth rate is estimated at 33.9 births/1,000, however with an infant mortality rate of 45/1000 and maternal mortality of 4.8/100018. Major diseases include acute respiratory infection, diarrhea, anemia and malnutrition, fever of unknown origin, injuries, heart diseases, diabetes and tuberculosis and recently hepatitis B virus infection being among the 19 key infections identified in the country [19].

Eritrea is categorized as a low income country with a majority of the population dependent on subsistence farming, pastoralism and fishing [20]. Remittances from abroad as well as mining are the main economic drivers of the country 20. However, there is a significant difference in poverty levels among the zobas and particularly the coastal and western lowlands had a disproportionate number of poorer households compared to the more urbanized zobas located in central and northern highlands [18]. The current study was conducted within 46 health facilities distributed across all the six zobas.

Study design

This cross sectional study was carried out as part of the 2016 nationwide antenatal care (ANC) sentinel surveillance for HIV, Syphilis, Hepatitis B, and Hepatitis C. The study was conducted following the guidelines published by the world health organization (WHO) for ANC sentinel surveillance [21]. The selection strategies for the 2016 surveillance included maintaining the 2013 sentinel surveillance sites to facilitate prevalence comparisons and generate prevalence that are representative of all zobas and sub-zobas of the country. A two-stage sampling design was employed. The first stage involved selecting ANC sentinel sites and in the second selection of ANC attendee women. Accordingly selection of the ANC sites was done using non- probability sampling taking into account representations by zoba and urban-rural; volume of ANC attendance; and availability of facilities for processing and storing blood specimen. A total of 46 health facilities were selected, out of which 20 were from urban areas and the remaining 26 from rural areas. The selected health facilities were grouped into 16 study sites grouped into urban and rural clusters within their respective zobas. A number of study sites had some satellite sites, which assisted the main site in the effort to reach the target sample size. The women were selected through consecutive sampling until the sample size was met for each site.

Study population

All pregnant women aged 15-49 visiting the ANC clinics for the first time in their pregnancy were selected, with those who were found to have visited any ANC clinic in their current pregnancy excluded from the study. A minimum sample size of 300 pregnant women was selected from each sampling site or cluster within a period of 10 weeks from January to March, 2016.

Data collection and processing

Socio-demographic data was collected using structured questionnaires. Data collected included information on zoba, age, religion, ethnicity, gravidity, Parity, marital status, level of education, occupation of the respondents and their partners. Data was entered using CSPro version 6.0 and it was then exported and analyzed by SPSS version 21. As the sample was not allocated in proportion to the distribution of health facilities providing ANC services within each zoba, the sentinel surveillance is not self-weighting. As a consequence a normalized design weights were introduced to compensate for over and under sampling to produce representative results at the zoba and national level. Binary logistic regression analyses were performed to test and correlate the different socio-demographic parameters to HBV exposure rates among the different categories of ANC attendees. In any case $p < 0.05$ was considered significant.

Blood sample collection and storage

For every participant 5ml of venous blood was collected and labeled in line with the already administered questionnaire.

The blood samples were centrifuged within 1 hour of collection and the separated serum was divided into two aliquots and immediately placed in a freezer at -20°C.

HBV serology

All serum samples were tested for HBsAg antigen marker using an ELISA - SURASE B-96 (General Biological Corp, Taiwan; Cat number: 4SGE3), sensitivity and specificity of 100% and 99.58% respectively. The anti- HBc antibody was measured by conjugated anti-HBc ELISA (DIA source immunoassays, Belgium Cat number: KAPG4CBE3) with 100 % and 99.8% sensitivity and specificity respectively. Antibodies against the surface antigen were detected using ANTISURASE B-96 ELISA (General Biological Corp, Taiwan Cat number: 4SBE3) with sensitivity and specificity of 100% and 99.8% respectively. All HBsAg reactive samples were tested for HBeAg/ anti-HBe Seromarkers using EASE BN-96 ELISA test kit (General Biological Corp, Taiwan; Cat number: 4BNE3) with a reported sensitivity and specificity of 98.5% and 99.1% respectively for HBeAg. The sensitivity and specificity for anti-HBe were more than 99%. The latter dual ELISA test kit detects the HBeAg marker using the sandwich principle and the anti-HBe antibody based on neutralization principle. All the sensitivity and specificity data were provided by the kit manufacturers. The HBV Seromarkers testing was done at the immuno serology laboratory of the National Laboratory of Health under the direct supervision of the principal investigators. Standardized procedures were developed and strictly followed during sample collection, transportation, storage and analytical processes. Positive and negative controls were run alongside of the test samples. All HBV test results were verified by a principal investigator before data entry.

Ethical consideration

Ethical clearance was obtained from the Eritrean Ministry of Health Research and Ethical Committee. In any case confidentiality of the participants was guaranteed and no significant harm was reported during the study.

Results

Socio-demographic characteristics

A total of 5009 participants were recruited from the six zobas and the sixteen study sites in Eritrea. The number of pregnant women included in the sentinel survey per zoba is presented (Table 1). The mean age of the study subjects was 26.7 ± 5.88years with ranges from 15 to 48 years. The highest number of participants 1623 (32.4%) were obtained from the age group 30 and above. More than 90% of the women reported being in a marriage relationship and 68% of all these participants had attained at least basic primary or higher educational level (Table 2). Data on obstetrics history indicators showed that 3926 (78.4%) and 2811 (56.1%) of the study participants were multigravida and Multiparous respectively (Table 2).

Table 1: Prevalence of HBsAg among pregnant women in the six zobas of Eritrea, 2016 (n= 5009).

Study Region	Health Facilities	HBsAg		95% CI	Overall Exposed	
		n/N	(%)		n/N	(%)
Total	46/240	163/5009	3.2	2.3 – 4.1	1525/5009	30.5
Anseba	10/27	8/367	2.3	0.9 – 3.6	114/367	31.2
Maekel	10/28	17/824	2.1	1.6 – 2.4	171/824	20.7
Debub	8/62	39/1279	3.1	0.9 – 5.3	446/1279	34.9
SKB	7/47	23/665	3.4	2.2 – 4.6	211/665	31.7
GB	7/72	72/1831	3.9	2.0 – 5.8	566/1831	30.9
DKB	4/4	3/43	7.5	0.0 – 16.8	17/43	39.7
Setting						
Urban	21/69	56/2482	2.3	1.7 – 2.7	659/2482	26.5
Rural	25/171	106/2527	4.2	3.0 – 5.5	867/2527	34.3

95% CI: 95% Confidence Interval; SKB: Semenawi Keiyh Bahri; GB: Gash Barka; DKB: Debubawi Keiyh Bahri

Site specific prevalence

The overall HBsAg prevalence among pregnant women was 3.2% (95% CI: 2.5-3.8), indicating a low intermediate prevalence of HBV among this group of women (Table 3). The prevalence of anti-HBc and anti-HBs seromarkers among the study participants was 25.8% (95% CI: 24.6-27) and 14.2% (95% CI:13.2-15.1) respectively. Among the HBsAg positive women 96% (95% CI: 93.0-98.9) and 5 % (95% CI: 1.8- 8.3) were positive for anti-HBc and anti-HBs antibody markers respectively. Approximately 30% of the study participants were positive for one or more of HBV Seromarkers and based on this the women were grouped into five categories; 163 (3.2%) HBsAg positive, 661 (13.9%) were isolated anti-HBc, 273 (5.5%) were isolated anti-HBs, 420 (8.9%) both anti-HBc and anti-HBs positive whereas the remaining 3484 (69.5%) of the 5009 were negative for any HBV Seromarkers. Among the 163 HBsAg positive pregnant women the prevalence of HBe antigen was 3.9% (95% CI: 1.0-6.8). The prevalence of anti-HBe among the HBsAg positive women accounted for 17.4% (95% CI: 11.1-23.6).

Based on regional prevalence of HBs antigen significant variation was observed with zoba Maekel having the lowest prevalence with 2.1% (17/824) and zoba Debubawi Keiyh Bahri presenting the highest prevalence of 7.5% (3/43) (Table 1). Similarly a significant (p=0.025) difference of HBV prevalence was observed with rural areas having higher prevalence than urban areas (Table 4).

Table 2: Characteristics of ANC attendee and seroprevalence of HBsAg in Eritrea, 2016 (n= 5009).

Characteristics	Total	HBsAg	95% CI	Overall Exposed
	N (%)	N (%)		N (%)
Age Group				
15-19	509 (10.2)	7 (1.4)	0.3 – 2.5	128 (25.2)
20-24	1329 (26.6)	40 (3.0)	1.7 - 4.0	376 (28.3)
25-29	1544 (30.8)	62 (4.0)	2.7 - 5.2	483 (31.3)
>30	1623 (32.4)	53 (3.3)	2.1 - 4.3	538 (33.1)
Marital Status				
Single	255 (5.1)	3 (1.1)	0.0 - 2.5	75 (29.5)
Married	4638 (92.7)	159 (3.4)	2.7 - 4.0	1417 (30.6)
Living with partner	93 (1.9)	0	0	26 (27.6)
Widowed /Divorced	17 (0.3)	1 (3.6)	0.0 – 10.8	7 (43.5)
Occupation				
Government	211 (4.2)	2 (0.7)	0.0 – 1.5	47 (22.2)
House wife	4428 (88.5)	153 (3.5)	2.6-4.0	1348 (30.4)
Private	262 (5.2)	7 (2.7)	1.1-5.3	94 (35.8)
Unemployed	100 (2.0)	1 (0.8)	0.0- 1.8	31 (30.6)
Spouse Occupation				
Unemployed	232 (4.6)	1 (0.3)	0.0 – 0.7	75 (32.4)
Government	2110 (42.3)	64 (2.9)	2.1-3.8	654 (31.0)
Private	1295 (25.9)	36 (2.7)	1.7-3.7	356 (27.5)
Farmer	1356 (27.1)	60 (4.4)	2.8-6.0	431 (31.8)
Education				
Illiterate	1576 (31.5)	73 (4.6)	3.1-6.1	526 (33.4)
Primary	1246 (24.9)	39 (3.1)	1.9-4.13	432 (34.7)
Junior	987 (19.7)	31 (3.2)	1.8-4.3	299 (30.3)
Secondary or higher	1201 (24.0)	20 (1.6)	0.9-2.3	268 (22.3)
Ethnicity				
Tigrigna	2874 (57.4)	85 (2.9)	2.1-3.6	900 (31.3)
Tigre	1108 (22.1)	30 (2.7)	1.5-3.8	287 (25.9)
Others	1027 (20.5)	48 (4.7)	2.7-6.6	339 (33.0)
Religion				
Christian	2772 (55.6)	81 (2.9)	2.1 – 3.6	875 (31.6)
Muslim	2271 (44.4)	82 (3.7)	2.6 – 4.7	645 (29.1)
Gravidity				
Primigravida	1083 (21.6)	17 (1.6)	0.6 - 2.5	268 (24.7)
Multigravida	3926 (78.4)	145 (3.7)	2.9 - 4.4	1257 (32.0)

Parity				
Nulliparous	1159 (23.1)	20 (1.7)	0.8 - 2.6	287 (24.8)
Primaparous	1039 (20.7)	29 (2.8)	1.4 – 4.0	324 (31.2)
Multiparous	2811 (56.1)	114 (4.0)	3.0 - 4.9	914 (32.5)

95% CI: 95% Confidence Interval

Table 3: Prevalence of hepatitis B Seromarkers detected in pregnant women in Eritrea, 2016 (n=5009).

Serological Markers	N*	%	95% CI
Overall Prevalence (n=5009)			
HBsAg	163	3.2	2.5-3.8
Anti-HBc	1241	25.8	24.6-27.0
Anti-HBs	706	14.2	13.2-15.1
Isolated anti-HBc	661	13.9	13.0-14.8
Isolated anti-HBs	273	5.3	4.7-5.9
anti-HBc and anti-HBs	420	8.9	8.1-9.6
Overall exposed to HBV	1525	30.5	29.5-32.0
HBsAg Positive (n=163)			
HBeAg	7	3.9	1.0-6.8
Anti-HBe	35	17.4	11.1-23.6
Anti-HBc	151	96	93.0-98.9
Anti-HBs	8	5	1.8-8.3

*= each marker could have missing data, 95% CI= 95% Confidence Interval

Table 4: Association of women characteristics with HBsAg positivity among ANC attendee in Eritrea (n= 5009).

Socio- Demographic Characteristics	cOR (95%CI)	p-Value	aOR (95%CI)	p-Value
Zoba				
Maekel	**Reference**		**Reference**	
Anseba	1.16 (0.59-2.27)	0.657	0.73 (0.338-1.58)	0.845
Debub	1.48 (0.75-2.92)	0.253	1.05 (0.592-3.89)	0.425
Semenawi Keiyh Bahri	1.66 (0.82-3.39)	0.162	1.07 (0.522-2.21)	0.844
Gash Barka	2.02 (1.09-3.73)	0.026	1.41 (0.805-2.48)	0.228
Debubawi Keiyh Bahri	4.20 (1.98-8.87)	<0.001	3.56 (1.56-8.16)	0.003
Setting				
Urban	**Reference**		**Reference**	
Rural	1.52 (1.09-2.12)	0.012	1.55 (1.05-2.28)	0.025
Education				
Illiterate	2.83 (1.76-4.57)	<0.001	2.00 (1.07-3.74)	0.029
Primary	1.93 (1.16-3.21)	0.012	1.60 (0.898-2.85)	0.11
Junior	1.67 (0.98-2.83)	0.058	1.43 (0.825-2.48)	0.202
Secondary or Higher	**Reference**		**Reference**	
Age Group				
15-19	**Reference**		**Reference**	

20-24	1.49 (0.69-3.24)	0.313	1.14 (0.480-2.58)	0.802
25-29	2.05 (0.97-4.33)	0.059	1.15 (0.484-2.76)	0.743
η 3ρ>30	1.65 (0.77-3.49)	0.196	0.76 (0.307-1.88)	0.556
Marital Status				
Single	**Reference**		**Reference**	
Married	1.90 (0.775-4.68)	0.227	1.38 (0.50-3.82)	0.525
Living with partner	0	0.997	0	0.997
Widowed /Divorced	3.90 (0.429-35.57)	0.997	2.49 (0.264-23.56)	0.425
Occupation				
Government	**Reference**		**Reference**	
House wife	2.59 (0.820-8.20)	0.105	1.45 (0.441-4.80)	0.537
Private	1.60 (0.263-9.70)	0.611	1.14 (0.170-7.66)	0.891
Unemployed	2.91(0.792-10.70)	0.108	2.23 (0.585-8.50)	0.24
Spouse Occupation				
Unemployed	**Reference**		**Reference**	
Government	1.42 (0.514-3.96)	0.496	2.34 (0.816-6.73)	0.114
Private	1.40 (0.498-3.95)	0.522	2.67 (0.912-7.83)	0.73
Farmer	1.77 (0.628-5.03)	0.279	2.44 (0.827-7.24)	0.106
Ethnicity				
Tigre	**Reference**		**Reference**	
Tigrigna	1.04 (0.686-1.57)	0.853	1.96 (0.836-4.60)	0.122
Others	1.68 (1.04-2.69)	0.031	1.29 (0.756-2.20)	0.349
Religion				
Christian	**Reference**		**Reference**	
Muslim	1.34 (0.97-1.85)	0.076	1.41 (0.682-2.91)	0.353
Gravidity				
Primigravida	**Reference**		**Reference**	
Multigravida	2.36 (1.39-3.97)	0.001	1.55 (0.404-5.95)	0.523
Parity				
Nulliparous	**Reference**		**Reference**	
Primaparous	1.67 (0.91-3.06)	0.099	0.99 (0.266-3.72)	0.995
Multiparous	2.49 (1.50-4.12)	<0.001	1.47 (0.404-5.417)	0.555

cOR: Crude Odds Ratio; aOR: Adjusted Odds ratio; 95% CI: 95% confidence Interval

Socio-demographic characteristics in relation to HBV prevalence

The risk of HBV infection, though not clearly significant was high within the age groups 25-29 (cOR=2.05: p=0.059) with a prevalence of 4% compared to other groups (Table 4). There was no significant association determined in relation to marital status, occupation, spouse occupation or religion. Although ethnicity showed some level of significant association for others ethnic groups (cOR=1.68; p=0.031) it suffices to note that there was no significant association between the two main ethnic groups of Tigrigna and Tigre. There was however a significant relationship between the rate of HBV infection and the level of education. Those who were categorized in the study as illiterate were significantly prone to HBV infection compared to those who had attained secondary or higher education (aOR=2.00: p=0.029) (Table 4).

Discussion

This is the first major study of its kind in Eritrea giving the prevalence of HBV in antenatal care setting. In as much as HIV has been a major concern in public health in many African countries, leading to prevention of mother to child transmission (PMTCT) cares. HBV in pregnancy is becoming a major concern. The low intermediate prevalence depicted in this study is similar to other findings made in Eritrea among blood donor population [4,22]. Hepatitis B infection in pregnancy continuous to grow as a major concern in Africa and the countries neighbouring Eritrea with Ethiopia [5-9], Sudan [11], South Sudan [12] and Yemen [13] in the middle east recording a prevalence of 3.8-7.8%, 5%, 11% and 10.8% respectively. Other countries like Kenya [10] and Uganda [23] have also reported significantly high prevalence of 9.3% and 11.8% within similar population of expectant mothers. In certain cases, prevalence of diseases are linked to certain socio-cultural or socio- economic dynamics. The significant difference observed in the zobas could be attributed to the socio-economic disparities between these zobas. Those zobas with low HBV prevalence are located in the central and northern highlands of Eritrea. These areas have a better infrastructure and socio-economic status as several of the major urban centres are located in this area. In contrast the zobas with a higher HBV prevalence are located in the western and eastern lowlands an area characterized by relatively underdeveloped infrastructure and low socio-economic status. Similar variation in *HBV* prevalence patterns were also reported in Kenya by Okoth et al. [10] ranging from 4.3-13.4% for the different regions of Kenya10. In addition a number of reports by different authors in various regions of Ethiopia also reported a varied HBV prevalence with lowest (3.8%) being reported in the central Amhara region5 and the highest (7.8%) in Southern region [7].

In this series the prevalence of HBV was higher among rural dwellers (4.2%) compared to urban dwellers (2.3%). In Eritrea the socio-economic disparities between rural and urban areas is well documented. The 2010 Eritrean population and health survey and the 2014 millennium development goal report indicate that poverty levels are particularly higher in rural areas as compared to urban areas [18,24]. More frequently many reports from Africa had indicated in rural settings the risk of HBV infection is higher as it is influenced among other things by poverty, access to health, poor hygiene and lack of education [25,26]. Similar findings were reported in Uganda, South Africa and Ghana in studies conducted among the general public and diverse population groups [26,27].

In the current study almost one third of the study participants (30.5%) were positive for one or more HBV seromarkers indicating a substantial exposure to HBV infection in Eritrea. But this figure is very low to what is reported in most sub-Saharan African countries for instance Angounda et al. [28] in a study conducted in Congo, Brazzaville reported 78.3% of pregnant women had at least one HBV seromarker [28]. Reports from sub-Saharan countries indicate that HBV infection is mainly transmitted horizontally during early childhood, but contrary to this, the findings of the current study demonstrates that a large pool of women are not exposed to HBV infection. The latter assertion makes this group of women vulnerable to HBV infection through other routes including sexual route. Taking this into consideration the low overall HBV exposure reported might be due to, among others the successes of the ongoing campaigns undertaken to prevent HIV infection îwith a prevalence of ≤ 1% [18]. Therefore in the Eritrean context the introduction and expansion of PMTCT, improved knowledge and change of sexual behaviors associated with the decreased HIV trend might have contributed to lower the HBV carriage rate among the ANC attendee [18,29].

The proportion of women showing signs of previous exposure in this study was 25.8% as evidenced by the prevalence of anti-HBc Seromarkers within the study participants. This finding once again is much lower when compared to what is usually reported in most sub-Saharan African countries; Congo 65.7% 28, 81.6% in Cote d'Ivoire [30], 61% in Zimbabwe [31]and 41% in Cameroon [32]. Even though the anti-HBc and overall exposure rates in this study are low, the regional exposure rates differed with some zobas reporting rates as low as 20.7% and some zobas recording rates as high as 39.7%. Similar pattern in HBV exposure and carriage rates are reported in many African countries with underlying causes associated with among other things differences in behavioral, socio-economic, socio-cultural practices and viral characteristics including circulating genotypes [26,27,33]. In developed countries much lower results were reported with 5% in Spain [34], 7.1% in Switzerland [35], and 13.4% in France [36].

The seroconversion rate in the current study was 14.2% indicated by the anti-HBs antibody prevalence but higher results were reported in Congo 22% [28] and Kenya 30.2% [10]. In this study 5.5% of the women have ever been vaccinated as indicated by the isolated anti-HBs marker prevalence, this seems a large proportion given HBV childhood vaccination was introduced in the country in 2002. However, as an emerging new nation a significant number of the population are returning refugees from neighbouring and other countries [18] including countries with established HBV vaccination programs for children and adults which could have contributed to this effect. Nonetheless the possibility of false positive results could not be ruled out. One of the limitations of the study was failure to measure IgM antibody to HBc antigen instead in this study total anti-HBc antibody was measured making it difficult to differentiate acute and chronic infections. However, one important observation among women positive for HBsAg was only 5% of the women were positive for anti-HBs antibody nonetheless 96% were positive for anti-HBc only which might indicate active virus replication. This might indicate presence of an increased chance of mother to child transmission among those groups of pregnant women.

The presence of HBeAg is an important indicator of infectivity with an increased risk of HBV transmission from mother to fetus [15]. The overall antigenemia of HBeAg among HBsAg positive pregnant women was 3.9% giving an overall prevalence of 0.14% amongst the study population. Considering this low HBeAg prevalence and the lower vertical transmission risk among dual HBsAg and HBeAg positive pregnant women in Africa [17] the risk of vertical transmission in Eritrea seems low. But this assertion suffers due to lack of data within Eritrea on circulating HBV genotypes and their molecular characteristics that could affect natural history of HBV infection [33]. The 3.9% HBeAg prevalence reported in the current study is comparable to the 3.4% reported in Congo, Brazzaville 28 while much lower results were reported

in Ethiopia (<1%) [37], Nigeria (1.7%) [38] and in Tanzania [39] and Saudi Arabia [40] none of the pregnant women were positive for HBeAg. However higher results were reported in Nigeria (30.3%) [41], Cameron (22.7% and 28%) [32,42] , Libya (21.7%) [43], Uganda (14.9%) [23] and Kenya (8.8%) [10]. Findings from the Asian continent indicate that presence of maternal anti-HBe conform some level of protection against HBV MTCT [44]. In sub-Saharan African countries most HBV infections takes place at early childhood with anti-HBe seroconversion taking place around the age of puberty [26,45]. As a result most women at reproductive age are positive for anti-HBe. Contrary to this, findings of this study indicated that approximately 82% of HBsAg positive women were negative for anti-HBe antibodies. Even though this result casts doubt on the sensitivity of the test used, it could also indicate that the latter group of women possesses an increased risk for MTCT. Moreover 70% of the pregnant women are naïve to HBV as they were negative for any HBV Seromarkers making them susceptible to HBV infection. The study was not calibrated to measure potential risk factors for HBV infection among the study participants. This might be a potential limitation to the study given the different prevalence reported in the different zobas. But the study to our understanding and limitations fully assessed the association of background characteristics with HBV positivity. Univariate logistic regression analysis revealed that zoba of enrolment, setting urban/rural, educational level, ethnic group, and the obstetric indicators gravidity and parity have a statistically significant association with HBV positivity ($p < 0.05$). But in the multivariate analysis significant association with HBV positivity is observed for the background characteristics zoba of enrolment, setting urban/rural and educational level with p-value < 0.05.

Conclusion

A low intermediate prevalence of HBV with a relatively low HBeAg carrier rate of 3.9% has been determined in this study. Further, the 30% of pregnant women determined for HBV Seromarkers indicate a potential substantial exposure to the virus among the study participants. It thus suffices to conclude that vaccination remains the best possible tool to mitigate risks of HBV infection. The existing child vaccination program, currently available in Eritrea, should be strengthened and maintained. Furthermore considering that child immunization program is introduced in 2002 and the findings in this study showing 70% of the study participants were negative for any HBV seromarkers, catch up vaccination programs for students and adult women of reproductive age should be considered. Moreover, the vaccination program should also target high risk groups including health care workers and traditional birth attendants. Introduction of HBV vaccine at birth giving priority to those areas with high HBV prevalence should be considered. As part of the latter, the pattern of perinatal and early childhood HBV transmission and potential of introducing birth dose HBV vaccine should be assessed. Screening for HBV as a package in HIV care should not be ignored especially in areas where HIV also remains a burden.

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Conflict of Interest

The authors report no conflicts of interest in this work.

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