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SERO-PREVALENCE AND RISK FACTORS FOR HEPATITIS B INFECTION AMONG WOMEN ATTENDING ANTENATAL CARE AT ST. ORSOLA HOSPITAL, THARAKA NITHI COUNTY, KENYA. A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: **Like many Sub-Saharan African countries, Hepatitis B virus (HBV) is endemic in Kenya, where diagnosis and patient management remain challenging, particularly in cases involving HBV comorbidities. However, the burden of the disease among pregnant women in Kenya remains unclear.**

Objectives: **To determine the prevalence, disease stages and associated risk factors for HBV infection among women attending Antenatal care (ANC) at St. Orsola Hospital in Tharaka Nithi County, Kenya.**

Design: **A cross-sectional study was conducted on women attending Antenatal care.**

Subjects: **Pregnant mothers attending ANC between September to December 2023.**

Main outcome measures: For each woman, age, marital status, occupation, level of education and risk factors were captured using a questionnaire after consenting. Hepatitis B serological markers; hepatitis B surface antigen (HBsAg), antibody to hepatitis B surface antigen (anti-HBs), antibody to hepatitis B core antigen (anti-HBc), and hepatitis B envelope antigen (HBeAg) were also profiled.

Results: **The overall prevalence of HBsAg was 6.5% (25/385; 95% CI: 4.3%–9.4%), indicating intermediate endemicity. Most infected participants were classified as inactive carriers 72% (n=18), while 16% (n=4) were chronically infected, 8% (n=2) had acute infection and 4% (n=1) were in recovery. Multivariable logistic regression analysis identified history of liver disease (AOR = 5.21; 95% CI: 1.11–24.43; p = 0.036), HIV infection (AOR = 9.84; 95% CI: 1.02–94.51; p = 0.047) and**

education level (AOR = 11.8; 95% CI: 1.5–93.4; p = 0.019), as independent predictors of HBV infection. Other factors including blood transfusion, dental procedures, tattooing, caesarean section, abortion and female genital mutilation were not significantly associated with HBV infection.

***Conclusion*: HBV remain endemic in this region like rest of the country with age, education levels, liver problems and human immunodeficiency virus (HIV) status being risk factors among pregnant women. The outcome of this research indicated a need for increased awareness and preventive measures not just among gravid women but also on entire population.**

Keywords: HBV, sero-prevalence, pregnant women, Antenatal care, Kenya

INTRODUCTION

Despite advancements in effective vaccines and antiviral treatments, chronic hepatitis b virus (HBV) infections continue to pose a significant public health challenge worldwide. Globally, over 370 million individuals suffer from chronic HBV, with Sub-Saharan Africa accounting for a notable share of this burden, with 65 million cases [1].

The prevalence of chronic HBV infection varies widely across regions, with high (>8%), intermediate (2-7%), and low (<2%) prevalence rates [2]. Sub-Saharan Africa is an endemic area exhibiting different prevalence levels depending on geographical location. The use of comprehensive HBV sero-markers; hepatitis B surface antigen (HBsAg), antibody to hepatitis B surface antigen (anti-HBs), antibody to hepatitis B core antigen (anti-HBc), and hepatitis B envelope antigen (HBeAg), to assess infection status, immunity, infectivity, and transmission risk is still limited in Kenya, especially in rural counties, despite national guidelines recommending routine screening of pregnant women for HBsAg during Antenatal care. As a result, there is insufficient information available regarding the actual prevalence of HBV infection, exposure history, immunity, and infectivity among pregnant women [3].

The babies born to mothers who test positive for HBsAg experience perinatal transmission (10–20%) of HBV; however, that rate can reach 90% in cases where both HBsAg and HBeAg are present [4]. Children born to mothers who are positive for HBsAg are carriers and at high chance of developing HBV consequences, including hepatocellular carcinoma (HCC) and cirrhosis, while those born to mothers who are HBeAg positive are at risk of infection even if they do not get sick during birth. In Kenya, HBV transmission primarily occurs vertically from mother to infant during childbirth and horizontally among school-aged children and adults through sexual transmission [4].

Several factors hinder HBV awareness, screening, vaccination, and treatment in resource-limited countries, including poverty, illiteracy, and lack of political will. Unawareness of ongoing infection can delay the diagnosis of HBV-related liver disease, facilitating the virus's spread [5]. Among pregnant women, risk factors vary across communities due to cultural practices and beliefs where the identified risk factors include lower education levels, a history of blood transfusion, surgery, abortions, sexually transmitted infections, higher mean parity, early sexual debut, polygamy, and an increased number of sexual partners [6].

Expectant women are notably at risk of HBV infection and can transmit the virus to their infants, children, sexual partners and healthcare workers during childbirth [7]. Therefore, there is a critical need to determine the sero-prevalence of HBV serological markers and associated risk factors among pregnant women attending ANC at St. Orsola Hospital in Tharaka Nithi County, Kenya.

MATERIALS AND METHODS

Design: A cross-sectional study was conducted, and a total of 385 consenting pregnant mothers were recruited using systematic random sampling after every 3rd consecutive mother attending ANC was sampled between September and December 2023.

Study site: The study was carried out at St. Orsola Hospital, Tharaka Nithi County Kenya. The facility serves an average number of 600 ANC mothers and a general population of 12,000 per month.

Inclusion criteria: Any consenting expectant woman who attended ANC at St. Orsola Hospital for ANC services with unknown HBV status was recruited into the study.

Sample size: The sample size of 385 participants was calculated using the Cochran formula for cross-sectional studies: $n=Z^2P(1-P)/d^2$

Where:

Z = 1.96 (95% confidence level)

P = 9.4% (previous Kenya prevalence)

d = 5% margin of error

The calculated minimum sample size was 131. To improve statistical power and precision of prevalence estimates, the sample was increased to 385 participants.

Data collection: A structured questionnaire containing social-demographic data on; age, social behavior and information on exposure variables were administered. About 5 mL of venous blood was collected in an EDTA BD tube vacutainer and used for sero-profile test.

HBV Sero-profile test

The screening for HBV markers; hepatitis B surface antigen (HBsAg), antibody to hepatitis B surface antigen (anti-HBs), antibody to hepatitis B core antigen (anti-HBc), and hepatitis B envelope antigen (HBeAg) was carried out using the Healthaw Medical one-step HBV-5 panel rapid diagnostic cassette (Hangzhou, China), adhering to the manufacturer's procedures. In order to examine whether HIV was a risk factor of HBV infections, HIV data was extracted from antenatal profile data.

Statistical analysis

Data were entered and analyzed using IBM SPSS version 20.0. Statistical analyses included: Descriptive statistics to summarize participant characteristics, bivariate logistic regression to estimate crude odds ratios (COR) for associations between HBV infection and potential risk factors. Variables with $p < 0.20$ in bivariate analysis were entered into a multivariable logistic regression model to identify independent predictors of HBV infection. Adjusted odds ratios (AOR) with 95% confidence intervals were reported. Statistical significance was set at $p<0.05$.

Ethical considerations

This research obtained ethical clearance from the Kenyatta University Ethical Review Committee (PKU/2238/I1382) and a permit from NACOSTI (license No: NACOSTI/P/22/15946). Additionally, approval was secured from the hospital review board (ERC-ST-OCMH/MSc/VOL.1/12) and study was conducted in accordance with Helsinki Declaration [8].

RESULTS

Socio-demographic Characteristics

A total of 385 pregnant women were enrolled, aged between 17 to 45 years with a mean age of 26.8 years and a standard deviation of 5.2. The majorities 151 (39.2%) were aged 21-25 years, 134 (34.8%) were 26-30 years, and 25 (6.5 %) were 16-20 years. Most participants were married in monogamous unions 310 (80.5%), while 51 (13.3%) were single and 24 (6.2%) polygamous. Occupations included business 150 (39.0%), casual labor 109 (28.0%), professional employment 66 (17.0%), and housewives 60 (16.0%). Regarding education, 137 (35.6%) had secondary, 122 (31.7%) primary, 70 (18.2%) tertiary education and 56 (14.5%) had no formal education. Participants with a low education level had significantly higher odds of HBV infection compared to those with high education level (COR = 16.52; 95% CI: 2.15–126.8; p = 0.007). After adjustment for potential confounders, level of education (AOR = 11.8; 95% CI: 1.5–93.4; p = 0.019) remained significantly associated with HBV infection. Other social-demographic factors including age, occupation and marital status were not significantly associated with HBV infection (Table 1).

Table 1

Social-demographic characteristics of pregnant in association with HBV infection among pregnant women at St. Orsola Hospital in Tharaka Nithi County (n=385)

Variable	Category	HBV Positive n (%)	HBV Negative n (%)	COR (95% CI)	p-value	AOR (95% CI)	p-value
Age	>30 years	7 (28.0)	68 (18.9)	1.67 (0.66-4.21)	0.280	—	—
	≤30 years (Reference)	18 (72.0)	292 (81.1)	1.00		1.00	
Education	≤Primary	24 (96.0)	154 (42.8)	16.52 (2.15-126)	0.007	11.8(1.5-93)	0.019
	Secondary/Tertiary (Reference)	1 (4.0)	206 (57.2)	1.00		1.00	
Marital status	Single/Polygamous	7 (28.0)	68 (18.9)	1.67 (0.66-4.21)	0.280	—	—
	(Monogamous) (Reference)	18 (72.0)	292 (81.1)	1.00		1.00	
Occupation	Informal occupation	23 (92.0)	296 (82.2)	2.49 (0.55-11.2)	0.240	—	—
	Formal occupation (Reference)	2 (8.0)	64 (17.8)	1.00		1.00	

**Reference categories are indicated in the table and assigned an odds ratio (OR) of 1.00. Adjusted odds ratios (AOR) were obtained from multivariable logistic regression analysis including variables with p < 0.20 in the bivariate analysis.*

Predictors of HBV infection among pregnant women visiting Tharaka Nithi hospitals

Participants with a history of liver disease had significantly higher odds of HBV infection compared with those without liver disease (COR = 6.15; 95% CI: 1.39–27.15; p = 0.017). Similarly, HIV-positive participants had significantly higher odds of HBV infection compared with HIV-negative participants (COR = 13.47; 95% CI: 1.55–116.86; p = 0.012). After adjustment for potential confounders, history of liver disease (AOR = 5.21; 95% CI: 1.11–24.43; p = 0.036) remained significantly associated with HBV infection. Similarly, HIV infection remained an independent predictor of HBV infection (AOR = 9.84; 95% CI: 1.02–

94.51; p = 0.047 while other risk factors were not significantly associated with HBV infection (p > 0.05) (Table 2).

Table 2

The predictors of HBV infection among pregnant women (n=385)

Variable	HBV Positive n (%)	HBV Negative n (%)	Crude OR (95% CI)	p-value	AOR (95% CI)	p-value
Blood transfusion						
Yes	2 (8.0%)	17 (4.4%)	1.89 (0.53–6.67)	0.420		
No	23 (92.0%)	368 (95.6%)	1.00			
Dental procedure						
Yes	3 (12.0%)	25 (6.5%)	1.99 (0.57–6.89)	0.280		
No	22 (88.0%)	360 (93.5%)	1.00			
Tattoo						
Yes	0 (0.0%)	11 (2.9%)	—	0.400		
No	25 (100.0%)	374 (97.1%)	1.00			
Caesarean section						
Yes	3 (12.0%)	17 (4.4%)	2.97 (0.83–10.59)	0.092		
No	22 (88.0%)	368 (95.6%)	1.00			
Liver problem						
Yes	2 (8.0%)	6 (1.6%)	6.15 (1.39–27.15)	0.017	5.21 (1.11–24.43)	0.036
No	23 (92.0%)	379 (98.4%)	1.00			
History of abortion						
Yes	2 (8.0%)	12 (3.1%)	2.71 (0.62–11.77)	0.186		
No	23 (92.0%)	373 (96.9%)	1.00			
FGM						
Yes	0 (0.0%)	2 (0.5%)	—	0.710		
No	25(100.0%)	383 (99.5%)	1.00			
HIV status						
Positive	1 (4.0%)	1 (0.3%)	13.47 (1.55-116.86)	0.012	9.84 (1.02–94.51)	0.047
Negative	24 (96.0%)	384 (99.7%)	1.00			

**Percentages calculated using total HBV positive (n=25) and HBV negative (n=385) as denominators.*

Sero-prevalence HBV Prevalence

Overall, 25 of 385 participants had detectable HBsAg, yielding a prevalence of 6.5% (25/385; 95% CI: 4.3%–9.4%). Majority of these, 72% (18/25) were inactive carriers, 16% (4/25) were chronically infected, 4% (1/25) in recovery and 8% (2/25) had acute infections while none of the infected women reported prior HBV vaccination (Table 3).

Table 3

HBV Serological Markers profile among pregnant women (n=25)

Serological test	Chronic HBV	Inactive HBV	Recovery HBV	Acute HBV	Immunization HBV
HBsAg	+	+	+	+	-
HBsAb	-	-	+	-	+
HBeAg	-	-	-	+	-
HBeAb	-	+	+	-	-
HBcAb	+	+	+	-	-
n= (25) Prevalence Rate (%)	4 16%	18 72%	1 4%	2 8%	0 0%

DISCUSSION

This study demonstrated a HBV prevalence of 6.5% among pregnant women in Tharaka Nithi County, placing the region in the intermediate endemicity category (2–8% prevalence). This is consistent with national estimates and comparable to findings from Sierra Leone (6.2%) and other East African countries with HBV infection level of between 2-8% [9]; [10]. The finding from this study was lower than previous studies conducted in Kenya from different selected hospitals in the country 9.3% and 9.4% [11]. However, the finding of this study was relatively higher compared to research conducted at Mbagathi hospital 3.8% [12].

The use of a five-panel HBV serological test in this study enabled improved characterization of infection status. The majority of infected participants were identified as inactive carriers (72%), while 16% were chronically infected, 8% had acute infection, and 4% were in recovery [13]. These findings highlight the importance of using comprehensive serological markers to better understand HBV infection stages rather than relying solely on HBsAg screening. However, due to cost constraints, many facilities often relies only on screening of HBsAg alone, which risks missing occult HBV (OB HBV) and increases the probability of perinatal transmission [14]. In this study, individuals detected with acute phase of infection collaborated with the previous studies. The low levels of HBeAg detected among carriers suggest an increased risk of horizontal transmission compared to vertical transmission [15]. The target population exhibited low proportions of vaccinated women, indicating the vulnerability of this population to HBV infection. The low coverage of HBV vaccination, including the lack of vaccination at birth, highlights the urgent need to implement vaccination policies [16].

This study indicates that education levels had a significant impact on HBV infection rates. The association with age highlighted those young mothers, particularly those aged 21 to 30 years, exhibited higher rates of infection, which mirrors findings from Ethiopia, Togo, and Cameroon. Additionally, lower levels of education are strongly associated with HBV infection, underscoring the importance of health literacy in prevention efforts [17]. These age-related trends could be linked to their higher sexual activity and exposure during peak reproductive years. Married participants also showed increased HBV incidence, likely due to sexual transmission [18]. This study shows low or nonexistent Human immunoglobulin (HBIG) vaccine coverage

among the studied population including the birth dose within 24 hours of birth. From this, those who were HBV infected were initiated on antiviral drugs at 28th week of pregnancy with the newborn from infected mother advised being vaccinated within 72 hours of birth and at week 6, 10 and 14 according to Expanded Programme on Immunization (KEPI) vaccination schedule.

This study revealed a significant association between lower levels of educational attainment and HBV infection. Lack of awareness on HBV infection could also increase the risk of infection. This finding concurs with findings from previous conducted in Africa who has shown the risk of HBV infection [19]. Those who had prior knowledge of HBV infection had other means to prevent infection.

The study results were consistent with those observed in Poland, where a history of liver problems was established as a significant contributing factor for HBV among expectant mothers [20]. This may be associated to the notion that individuals with pre-existing liver conditions, such as liver cirrhosis or chronic liver disease, may have a compromised liver that is more susceptible to the effects of HBV infection. In such instances, HBV can exacerbate liver damage and worsen existing liver conditions [21]. Additionally, liver issues can lead to impaired liver function, including reduced production of clotting factors and diminished detoxification abilities. Nevertheless, HIV has been identified as a contributing factor for HBV infection based on its shared routes of acquisition.

Participation in high-risk activities, such as involvement with more than one sexual partner or using injectable drugs, can increase the chances of acquiring both infections. Individuals who are already infected with HIV are at increased chance of contracting HBV if they are exposed to it, as HIV can weaken the immune system, reducing the body's effectiveness in fighting off infection. Therefore, the HIV infected individuals are at higher chance of acquiring HBV upon exposure to the virus [21].

CONCLUSION

The proportion of study participants infected with HBV was 6.5%. Moreover, liver issues, HIV status, age, and educational attainment showed a notable relationship with the risk of HBV infection. The study findings support the need for routine HBV screening, universal infant birth-dose vaccination, and continued molecular surveillance to monitor strains diversity and potential resistance mutations in the region.

Study Limitation

This study had several limitations. First, the cross-sectional design limits the ability to determine causal relationships or temporality between exposure variables and HBV infection. Second, the study was conducted at a single hospital, which may limit external validity and generalizability to the entire Tharaka Nithi county or national population.

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