Journal of Advances in Medicine and Medical Research

29(3): 1-12, 2019; Article no.JAMMR.33102
ISSN: 2456-8899
(Past name: British Journal of Medicine and Medical Research, Past ISSN: 2231-0614, NLM ID: 101570965)

Associated Risk Factors and Seroprevalence of Hepatitis B among Pregnant Women Attending Antenatal Clinic in a Rural Setting of Cameroon (Penka-Michel)

Laure Brigitte Kouitcheu Mabeku[1*], Constantin Tchakounte[1], Tchouangueu Thibau Flaurant[2] and Francois-Xavier Etoa[2]

[1]Department of Biochemistry, Faculty of Science, Microbiology and Pharmacology Laboratory, University of Dschang, P.O.Box 67 Dschang, Cameroon.
[2]Department of Microbiology, Faculty of Science, University of Yaoundé I, P.O.Box 812 Yaoundé, Cameroon.

Authors' contributions

This work was carried out in collaboration among all authors. Author LBKM designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors CT and TTF managed the analyses of the study. Author FXE participated in the design of the study and managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JAMMR/2019/v29i330072
Editor(s):
(1) Dr. Faris Q. B. Alenzi, Department of Medical Laboratories, College of Applied Medical Sciences, Salman bin Abdulaziz University (Al-Kharj), Al-Kharj, Saudi Arabia.
(2) Dr. Mohammed Rachidi, Molecular Genetics of Human Diseases (MGHD), French Polynesia, University Paris 7 Denis Diderot, Paris, France.
Reviewers:
(1) Jerzy Bełtowski, Medical University, Lublin, Poland
(2) Thompson J. Akinbolaji, Ekiti State University Teaching Hospital, Ado-Ekiti, Ekiti State, Nigeria.
(3) Dr. Emeka Ejeliogu, University of Jos, Nigeria.
Complete Peer review History: http://www.sdiarticle3.com/review-history/33102

Original Research Article

Received 19 January 2017
Accepted 25 April 2017
Published 28 March 2019

ABSTRACT

Background: Vertical transmission is an important route of transmission for hepatitis B virus infection. Despite the introduction of HBV vaccine in the extended immunization program in 2005, Cameroon has remained a hyper-endemic area. The aim of this study was to determine the seroprevalence of hepatitis B Virus among antenatal clinic attenders in Penka-Michel-Cameroon, and to identify potential risk factors associated with the infection for a better prevention of the disease.

**Corresponding author: E-mail: lauremabek@yahoo.fr;*

Study Design: The study was a case control study conducted in four reference hospitals in Penka-Michel, a rural area in west region of Cameroon during April to July 2014.
Methodology: Six hundred and forty three (643) pregnant women were recruited. The DiaSpot HBsAg *in vitro* diagnostic test strips were first used. Positive samples were further confirmed for HBsAg, HBeAg, anti-HBs, anti-HBe and anti-HBc using an immunoassay kit. Liver enzymes (ALT, AST and ALP) were also evaluated for HBsAg positive samples using TECO DIAGNOSTICS kit. A structured questionnaire was used to collect information on sociodemographic parameters and predisposing risk factors of hepatitis B from each patient. Data collected was analyzed using Graph Pad prism version 5.03.
Results: The prevalence of hepatitis B infection (HBsAg) in our setting was 4.7%. Fifty percent of HBsAg positive women were also HBeAg positive and 46.7% of them lack antibodies against hepatitis B e antigen. All the HBsAg positive women had previous contact with HBV and just 3.3% of them were immunized against HBV. Women in the age groups 31–35 years were significantly more affected (X^2 16.95, P = .0045). Only a history of a contact with hepatitis B infection was significantly associated with HBsAg and HBeAg positivity (X^2 27.45, P = .0001; X^2 25.31, P = .0003).
Conclusion: Administration of HBIG in combination with hepatitis B vaccine as post-exposure prophylaxis for infants born to HBV infected mothers is of paramount importance. In addition, universal HBsAg screening of all pregnant women will greatly assist in reducing the maternal transmission of HBV in Cameroon.

Keywords: Hepatitis B; seroprevalence; pregnant women; rural setting; Cameroon.

1. INTRODUCTION

Hepatitis B virus (HBV) infection is a major global health problem. It is estimated that more than two billion people have been infected with HBV world wide and 350 million people have chronic infection of whom 65 million live on the African continent [1]. Sub-Saharan Africa has a high endemicity, and more than 50 million people are believed to be chronic carriers of the HBV [2]. Infection with hepatitis B virus (HBV) leads to a wide spectrum of clinical presentations, ranging from asymptomatic carrier state to acute self-limiting infection or fulminant hepatic failure, chronic hepatitis with progression to cirrhosis, and hepatocellular carcinoma (HCC) [3,4]. The hepatitis B surface antigen (HBsAg) in serum is the first seromarker to indicate active HBV infection, either acute or chronic, whilst the soluble extractable protein, the Hepatitis e antigen (HBeAg) is a marker for the highly infectious state [5]. The virus is transmitted through infected blood or other body fluids, and vertically (mother to child) in the perinatal period. Transmission of HBV from carrier mothers to their babies during the perinatal period appears to be the most important factor in determining the prevalence of infection in high endemicity areas [6,7]. Without immune prophylaxis, in mothers who are both HBsAg and HBeAg positive, the risk for transmission to the baby is between 70 and 90% by 6 months of age, whereas in the case of mothers who are HBsAg positive, but HBeAg negative, it is less than 10% [8-10].

The risk for development of chronic hepatitis B infection varies inversely with the age at which infection occurs, 90% of affected infants develop chronic infection as opposed to 30-50% of under-five children and 6% of children above five years of age [11,12]. Chronic hepatitis B infection acquired in childhood carries a 25% risk for development of chronic liver disease, cirrhosis or hepatocellular carcinoma [13]. Hence, it is imperative to prevent mother to child transmission. A combination of active and passive immune prophylaxis is the optimum strategy to prevent HBV infection in babies of HBsAg positive mothers. A combination of hepatitis B immune globulin (HBIG) and hepatitis B vaccination initiated within 24 hours of delivery has been shown to protect 85 to 95% of babies whose mothers were positive for both HBsAg and HBeAg [14]. However, studies have shown significant gaps in hospital practices and policies to prevent vertical transmission of hepatitis B [15]. As a result of this, maternal screening is necessary for the treatment of newborns in the endemic areas. In addition, viral hepatitis during pregnancy is associated with a high risk of maternal complications, and has been reported as a leading cause of maternal mortality [16].

Cameroon has high endemicity of HBV infection, with population prevalence rate up to 8% [17].

Many of these people may not be aware of the infection and hence fail to seek appropriate medical attention therefore progressing to chronic liver disease, cirrhosis and hepatocellular carcinoma. Most of the previous studies carried out on HBsAg among general population, principally in urban setting, [18-21] showed that Cameroon has remained a hyper-endemic area for hepatitis B virus infection, despite the introduction of HBV vaccine in the extended immunization program in 2005. To the best of our knowledge, few studies have been done on the prevalence of HBV among pregnant women in Cameroon particularly in urban setting [22-24]. As a result, guidelines and other adequate information on the prevention and control strategies are lacking in rural areas. The objectives of this study therefore are to determine the seroprevalence of hepatitis B virus among pregnant women attending antenatal care in Penka-Michel, a rural setting of Cameroon and to identify potential risk factors associated with the infection for a better management of the disease.

2. METHODS

2.1 Study Area

The study was performed in Penka-Michel, a rural area covering about 276 square kilometers, in west region of Cameroon with 124 880 people and a growth rate of 6.8% per year. Penka-Michel is located between latitude 21.52, 5º and 31.41, 5º north of the equator and longitude 7.39, 10º and 20, 10º east of the Greenwich Meridian. It has an altitude of about 1500 m above sea level [25]. It enjoys two distinct seasons, a short dry and a long rainy season. The highest rainfall registered in a year could reach 345.1 mm and the thermal amplitude between the hottest month of the year (March: 21.5ºC) and the coolness one (August: 18.9ºC) is 2.6ºC [25]. Penka-Michel is a nearest rural city of the University of Dschang and has been endowed with agricultural viability.

2.2 Study Population

This was a case control study conducted at the District Medical Center of Balessing (CMA-B), the District Medical Center of Bansoa chefferie (CMA-BC), the District Medical Center of Eglise Evangelique du Cameroun (CAA-EEC) and the District Hospital of Penka-Michel a rural area in the west region of Cameroon. These four health centers are the biggest hospitals in Penka-Michel and its environs. Thus, our sample was representative of all variety of pregnant women in Penka-Michel. The study recruited 643 pregnant women attending antenatal care in the four above cited hospitals during the study period. The sample size was calculated using Lorenz formula as follows $N = z^2 p (1-p) / \&^2$ (where z = the standard normal deviation at 1.96 (which corresponds to a 95% confidence interval), p = the prevalence of Hepatitis B in the general Cameroonian population, estimated at 10%; and & (degree of precision expected) = 0.05). The study lasted four months, from April to July 2014 and we employed a consecutive sampling for data collection, requesting consent from all antenatal clinic attendees in the selected health facilities during the study period. We excluded all women who refused to give consent.

2.3 Variables

Following informed consent, all pregnant women were interviewed using a standard questionnaire. This questionnaire was applied to collect relevant socio-demographic data of the women such as age, occupation, education status (non formal education, primary level, secondary level and university or more level), marital status (single, married), gravidity (Primigravidae, multigravidae) and gestational age. It was also used to collect information on predisposing factors for hepatitis B infection in order to test their association with HBV infection among pregnant women in our community. These included a previous history of blood transfusion, a history of previous surgery (cesarean sections, dilatations and curettage for miscarriage and retained placenta), history of previous tissue transplant, a history of scarifications/tattoos, type of marriage (monogamous or polygamous) polygamous used as a proxy indicator for multiple sexual partners.

2.4 Sample Collection

After completion of the questionnaire, 5 ml of blood was aseptically collected from each participant by clean venepuncture and dispensed into a clean, dry glass test tube. The blood samples were then spun in a centrifuge at 2,500 rpm for 5 minutes to separate the serum which was used for biological analysis.

2.5 Serological Analysis

After centrifugation, the serum was first tested for Hepatitis B surface antigen (HBsAg) using the

Dia Spot® HBsAg Test strips (Dia Spot Diagnostics, USA). All initially positive tests were confirmed for Hepatitis B surface antigen (HBsAg) using ELISA kit (OnSite HBV-5 Rapid Test, CTK Biotech, Inc. USA). In order to determine recovery and immunity from hepatitis B virus infection, initially positive tests were evaluated for the Hepatitis B surface antibody (anti-HBs) using the same ELISA kit (OnSite HBV-5 Rapid Test, CTK Biotech, Inc. USA). Confirmed HBsAg positive samples were also chosen for evaluation of infectivity by testing for the Hepatitis B e antigen (HBeAg) and the Hepatitis B e antibody (anti-HBe) using the same ELISA kit above. Confirmed HBsAg positive samples were equally evaluated for the Hepatitis B core antibody (anti-HBc) in order to determine previous exposure to HBV within the study population using also the same ELISA kit. All test procedures were carried out according to the manufacturers' instructions. Hepatocellular damage for HBsAg positive samples were also evaluated by estimating the activities of serum aminotransferase (ALT and AST) and alkaline phosphatase (ALP) using diagnostic kit (TECO DIAGNOSTICS, USA).

2.6 Statistical Analysis

The data collected were first checked for obvious errors before they were entered into a computer. Using GraphPad prism version 5.03, the data generated were analyzed with chi-squared ($\chi 2$) test, reporting corresponding p-values. The level of statistical significance for the study was set at $p < 0.05$. A control group made of pregnant women who were HBsAg negative was used to compare the strength of the association between reported risk factors and infection with Hepatitis B virus. The odds ratio and the corresponding 95% confidence intervals (95% CI) were used to summarize the strength of association.

3. RESULTS

3.1 Socio-demographic Characteristics

A total of 643 pregnant women were enrolled in this study. Their age varied between 15 and 50 years with a mean age of 27.1 ± 2.51 years. Majority of the study population are in the 21 to 25 years age group constituting 25% of the total population. Most of these women (80%) were married with 182 (35.4%) in monogamous and 332 (64.6%) in polygamous marriages. Over 92 % of the women possessed primary and secondary levels of formal education, with major occupations as housewives (47.43%) and farmers (18.2%). The subjects had the least percentage of women with university level of formal education (3.11%), while health workers constituted the least occupational group (2.64%). In relation to gravidity, most of the subjects were multiparous (76.04%), whereas few of them had more than 6 children (18.20%). Sixty three (9.8%) of the women were at the first trimester of gestation while 254 (39.5%) and 326 (50.7%) were at second and third trimester, respectively. Table 1 summarizes the socio-demographic characteristics of the study participants.

3.2 Prevalence of Hepatitis B virus Infection

Table 2 summarizes the prevalence of serological makers of Hepatitis B infection among the pregnant women. The Hepatitis B surface antigen (HBsAg) was detected in the serum of 30 of these women, giving an overall HBsAg prevalence of 4.7%. Just one out of 30 (3.3%) HBsAg (+) women also tested positive for Hepatitis B surface antibody (anti-HBs). This means that one woman has made recovery and immunity from hepatitis B virus infection. The remainder (96.7%) lacked anti-HBs, thus indicating that the majority of the patients have chronic HBV infection.

Among the 30 women who tested positive for HBsAg, 15 (50%) tested positive for HBeAg, thus indicating that this proportion of patients was highly infectious, and therefore likely to transmit the virus to their unborn babies.

Results of testing for anti-HBe for the 30 HBsAg (+) patients showed that, 46.7% (n = 14) lacked anti-HBe antibody. This implies a higher proportion of women were thus at risk of active viral replication. The remainder (53.3%) had anti-HBe antibody, indicating they were sero-converting.

Hepatitis B core antibody (anti-HBc) appears at the onset of symptoms in acute Hepatitis B and persists for life. This marker was also evaluated amongst the 30 women tested positive for HBsAg. Of these, 30 (100%) were positive for anti-HBc, hence had serologic evidence of previous HBV exposure or ongoing infection with hepatitis B virus within an undefined time frame.

Table 1. Demographic characteristics of the study participants (n=643)

Characteristics	Number (n = 643)	Percentage (%)
Age (years) (Mean = 27.1; SD = 2.51)		
15-20	111	17.3
21 – 25	161	25
26 – 30	155	24.10
31 – 35	125	19.44
36-40	70	10.9
41+	21	3.3
Gravid status		
Primigravidae	154	23.95
Multigravidae	489	76.05
Marital status		
Single	129	20.07
Married	514	79.93
Educational status		
No formal education	29	4.51
Primary	232	36.08
Secondary	362	56.3
University or beyond	20	3.11
Occupation		
Housewives	305	47.43
Traders	31	4.82
Civil servants	30	4.66
Students	74	11.51
Farmers	117	18.2
Health workers	17	2.64
Public servants	69	10.73
Gestational age		
1st trimester	63	9.8
2nd trimester	254	39.5
3rd trimester	326	50.7

Table 2. Prevalence of serological makers of hepatitis B infection by age among the pregnant women (n = 643)

Age group	Number	HBsAg + (%)	HBeAg + (%)	Anti-HBs + (%)	Anti-HBe + (%)	Anti-HBc + (%)
15-20	111	6 (5.4)	6 (5.4)	0 (0.00)	0(0.00)	6 (5.4)
21-25	161	3 (1.86)	3(1.86)	0(0.00)	3(1.86)	3(1.86)
26- 30	155	6 (3.87)	0(0.00)	0(0.00)	6(3.87)	6(3.87)
31- 35	125	13 (10.40)	4(3.2)	1(0.80)	6(4.8)	13 (10.4)
36-40	70	0 (0.00)	0(0.00)	0(0.00)	0(0.00)	0(0.00)
41+	21	2 (9.5)	2(9.5)	0(0.00)	1(4.8)	2(9.5)
Total	643	30	15	1	16	30
		X^2 = 16.95 P = 0.0045	X^2 = 15.38 P = 0.0095	X^2 = 4.150 P = 0.5280	X^2 = 8.803 P = 0.1172	X^2 = 16.98 P = 0.0046

The strength of the association between socio-demographic parameters evaluated and infection with Hepatitis B virus was studied. Our finding showed a statistically significant relationship between age group and HBsAg, HBeAg status, with a significant higher risk of being HBsAg positive amongst those in the age group 31 to 35 years (*P = .0045*) and age group 15-20 (*P = .0046*) for being HBeAg positive, relative to those in other age group (Table 2).

The strength of the association between women's occupation and HBsAg, HBeAg status was also statistically significant (*P* < .05), with a significantly higher risk of being infected amongst health workers, relative to those in other

occupation group. Our findings showed that 23.53 % (*P* = .0001) and 17.6 % (*P* = .0003) of health workers were respectively sero-positive for HBsAg and HBeAg (Table 3).

Unlike the above socio-demographic parameters, the association between gravidity, marital status, educational level and HBsAg or HBeAg status was no statistically significant. The mean gravidity was 3.7 ±1.1. There was a positive relationship between gravidity and HBsAg, HBeAg status (Fig. 1). Twenty one (70 %) of the 30 pregnant women that were sero-positive to HBsAg were multiparous. Thirteen (87 %) of the 15 pregnant women that were sero-positive to both HBsAg and HBeAg were multiparous.

An inverse relationship between educational level and HBsAg and HBeAg status was obtained with women with university level of education more affected than those with other levels of education (Fig. 2).

In terms of marital status, HBsAg and HBeAg positivity was higher among the married mothers (5.25 and 2.53 %) than among the single (2.53 and 1.55 %) (Fig. 3).

3.3 Hepatitis B Infection and Risk Factors

Table 4 highlights the relationship between known risk factors and HBsAg positivity. None of the women recruited in our study had a previous history of blood transfusion, a history of previous surgery or history of previous tissue transplant. Consequently it was not possible to evaluate these parameters as risk factors in our study population. However, 428 women recruited had a history of scarifications/tattoos and 332 were in polygamous marriage. 5.6% (24/428) of women with scarifications were tested positive to HBsAg, this was not statistically significant (*P* = .1177). Of the 332 polygamous women, 22 were positive to HBsAg, this was also not statistically significant (*P* = .0646).

The results obtained from the titration of the liver enzyme of HBsAg positive samples shows that 22 of 30 (73.33%), 18 of the 30 (60%) and 16 of 30 (53.33%) samples had range value greater than the normal respectively for ALAT (> 40 UI/L), ASAT (> 40 UI/L) and ALP (> 279 UI/L). This may suggest a liver cell injury to the respectively proportion of HBsAg positive women, since diseases such as viral hepatitis affect primarily hepatocytes.

4. DISCUSSION

The prevalence of HBsAg among our sample is 4.7%. Our prevalence is comparable to that of Ndumbe *et al.* (1994) [22] who reported a 5.4% prevalence among pregnant women in a rural setting in Cameroon. It is comparable to the 6.4%, 6.5%, 4%, 5.6%, and 4.3% reported in Ghana [26], Congo [27], Tunisia [28], Sudan [28], and Jordan [29] respectively among pregnant women. We detected HBsAg in 4.7% of the pregnant women examined, which is lower than the rate reported in the general Cameroonian population. Previous studies conducted on the prevalence of HBsAg among blood donors in Yaounde-Cameroon have reported HBsAg seroprevalence rates of 10.7% in 2003 [19], 10.8% in 2011 [20] and 12.4% in 2012 [21]. This result could be due to the fact that HBV infection in Cameroon is related, among other factors, to the male gender. But this need to be further confirmed. Our results are lower than earlier reports of HBsAg prevalence among pregnant women in Cameroon. Previous studies carried out among pregnant women in Yaounde, an urban setting in Cameroon by [23] Kfutwah et al. (2012) and by Fomulu et al. (2013) [24] have reported HBsAg seroprevalence rates of 7.85 and 7.7% respectively. The different settings and

Table 3. Association between HBsAg and HBeAg status and women's occupation

Occupation	Number	HBsAg + (%)	HBeAg + (%)
Housewives	305	11(3.60)	6 (2)
Students	74	0	0
Traders	31	3 (9.67)	2 (6.45)
Farmer	117	9(7.69)	2 (1.7)
civil servants	30	3(10)	1(3.33)
Health workers	17	4 (23.53)	3 (17.6)
Public servants	69	0	0
		X^2 = 27.45	X^2 = 25.31
		P = 0.0001	P = 0.0003

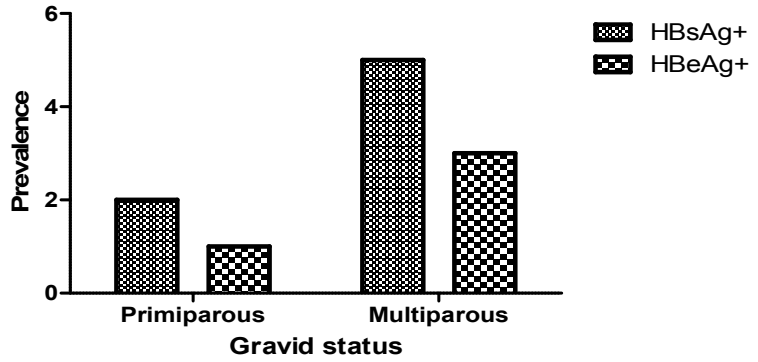

Fig. 1. Relationship between gravidity and HBsAg, HBeAg status in the study population

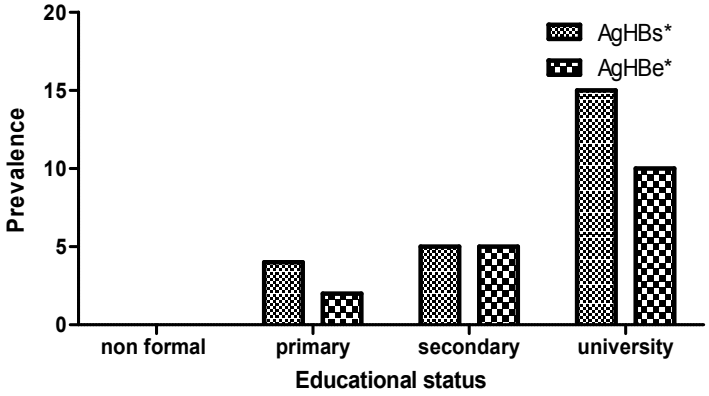

Fig. 2. Relationship between educational level and HBsAg, HBeAg status in the study population

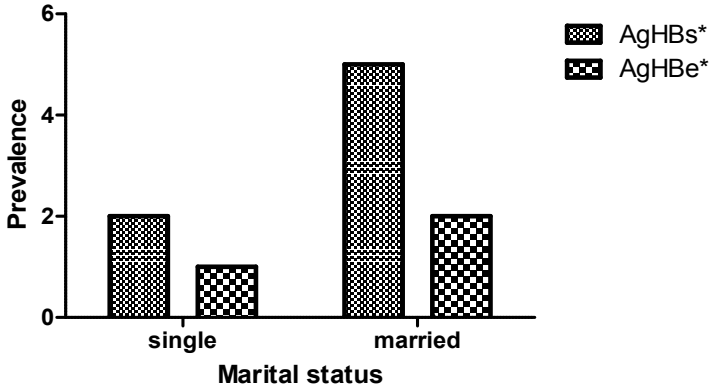

Fig. 3. Relationship between marital status and HBsAg, HBeAg status in the study population

study populations between our study and those previous studies could explain such results. One may estimate that urban dwellers probably have a higher risk of acquiring the infection that those in rural settings. This hypothesis however needs to be evaluated. Our prevalence is also lower than the 8.3% reported by Luka *et al.* (2008) [30] in an urban setting in Nigeria and by Eke et al. (2011) [31] in a rural setting still in Nigeria, the 9.3% HBsAg prevalence reported in Kenya [32]

and the 10.7% HBsAg prevalence in Burkina Faso [33]. Our result is significantly lower than the 25% prevalence of HBsAg reported by Madzime et al. (1999) [34] among pregnant women in Zimbabwe. On the contrary, our results are higher than the 1.2% HBsAg prevalence reported among antenatal clinic attendees in South Africa [35]. Geographical differences may explain the variation in seroprevalence rates of HBsAg among pregnant women from different countries. Studies have shown that variation may even exist among regions of the same country [36,37].

All our HBsAg positive participants showed evidence of previous exposure to HBV as evidenced by the 100% of anti-HBc positivity within this population. This proportion is comparable to that reported by Ndumbe et al. (1994) [22] among pregnant women in a rural setting in Cameroon (85%). It is however higher than the anti-HBc seroprevalence among pregnant women in the developed world, with reports ranging from 7.1% in Switzerland [38], through 13.4% in France [39], and 29.65% in China [40]. These results highlight the fact that HBV is very much present in our community and the risk of HBV acquisition in our community is high. Despite the high risk of acquisition of HBV in our community, just few of pregnant women have ever been vaccinated against HBV as evidenced by the 3.3% of anti-HBs prevalence within our study population. This shows a massive lack of awareness concerning HBV infection in our study population and the need for anti HBV vaccination.

It is known that the risk of vertical transmission and resulting chronic carrier infection from an HBsAg (+) mother to her baby is approximately 90% in HBeAg positive pregnant women with high HBV DNA titres [41,42]. In our study, we found that 50 % of HBsAg positive women were equally HBeAg positive, indicating that pregnant women could serve as an important reservoir to fuel the perinatal and childhood transmission of HBV within our community. Furthermore, our findings indicated that 46.7% of HBsAg positive patients lacked anti-HBe antibodies, which is an indirect indicator of the active viral replication. This observation indicates the active infection status of those women. This emphasizes the need to equip mothers with knowledge to prevent horizontal transmission of hepatitis B infection and to sensitize them on the importance of anti HBV vaccination.

We also found that most of the patients fell within the age group 21-25, 26-30 and 31-35 because these were the majority age groups that attended the antenatal clinics of the hospitals surveyed in this study. From table 2, the age group most affected using HBsAg is 31-35 years (10.4%) followed by 41+ (9.5%), so using age group the prevalence was statistically significant between women aged greater than 31 years than those aged less than 31 years (P = .0045). The prevalence of HBeAg was also significantly (P = .0095) higher among the 15-20 years age groups (6/111; 5.4%). This age distribution was not similar to the findings of Ndumbe et al. (1994) [22] in Cameroon, and Eke *et al.* (2011) [31] in Nigeria who found the highest prevalence of HBsAg among the 10-19 age group (10.4%), and the 15–19 age group (16.7%) respectively. Our findings somewhat tally with Mortada et al. (2013) [43] which reported that HBV was detected at a higher rate in pregnant women aged greater than 25 years than in women aged less than 25 years. However, the difference was not statistically significant. Habiba and Memon (2007) [44] from Pakistan also reported that the majority of those that tested positive to HBV were in the age range 25-35 years which was similar

Table 4. Association between HBsAg status and the predisposing factors

Risk factors		Number	HBsAg (+)	HBsAg (-)	OR ; 95% C.I	P value
Tattooing/	Yes	428	24	404	2.069 ;	0.1177
scarification	No	215	6	209	0.8327 - 5.142	
Blood transfusion	Yes	0	0	0		
	No	643	30	613		
Tissue transplant	Yes	0	0	0		
	No	643	30	613		
Previous surgeries	Yes	0	0	0		
	No	643	30	613		
Type of marriage	Mono	182	5	177	0.3950 ;	0.0646
	Poly	332	22	310	0.1481 - 1.070	

(Mono: Monogamous, Poly: Polygamous)

to this present study. Other studies also observed a high prevalence rate of HBV in pregnant women greater than 25 years than those less than 25 years [26,45]. A possible reason for the higher HBsAg prevalence in the age group greater than 25 years is the fact that the age groups 21-30 years were the most sexually active and fertile. The increased age among HBV positive mothers may be also due to increase in the chance of exposure to HBV for each pregnancy. This observation is further highlighted by the fact that the HBsAg and HBeAg seroprevalence rate increased with gravidity even though this was not statistically significant. Azhar *et al.* (2012) [46] reported a higher frequency of HBV infection among multigravidae. Multigravidae women might be at increased risk of HBV infection because of repeated risk of exposure to contaminated surfaces and instruments during delivery [47]. Therefore, with each pregnancy and childbirth chances of exposure to HBV become greater.

In relation to marital status, HBsAg and HBeAg seropositivity was higher among the married mothers (5.25 and 2.53 %) than among the single (2.53 and 1.55 %) (Fig. 3). Other studies have found higher prevalence among married women or formerly married women. Such variations may imply that marital status per se is not a risk factor for HBV infection but an indicator to consider the sexual partner as a risk factor.

This study found a correlation in terms of occupation and HBsAg, HBeAg seropositivity. The female health workers constituted the bulk of HBV seropositivity cases with 23.53 % for HBsAg and 17.6 % for HBeAg, this was statistically significant (P = .0001 and P = .0003 respectively). The reason for this is clear, since those women are frequently in contact with patients or their body secretion. Hence, our findings are in accordance with other reports which indicate that the risk of HBV transmission is high in people who are frequently in contact with infected HBV subjects [31, 48, 49]. Possible measures could include universal vaccination against HBV of at risk groups such as health workers, blood bank workers, and those with a contact known to be infected with HBV.

None of the female students in our study population was infected. The reason for this may be because of the awareness concerning transmission routes of HBV infection amongst women of this occupation group. This indicates the importance of education on prevention of high risk behaviors as a prevention strategy. One would have expected a positive relationship between educational status and HbsAg seropositivity with less educated women showing the highest positivity because of lack of knowledge concerning contraction routes or risk factors of HBV infection. However, the reverse was the case as the prevalence was higher among women with university level of education (3/20; 15%). Such variations may imply that possession of formal education is not perceived as a risk factor for HBV infection, since our findings showing that the HbsAg positivity amongst student women in our study population was null. It is likely that most of the women with university level of education enrolled in our study were no longer students at the time of the study and consequently were no longer considered as students. This brings to light the fact that after finishing with their school women do not apply their background knowledge in their daily livings, probably due to unemployment. This emphasizes the need of sensitization and education activities of Cameroonian population regarding the risks involved in Hepatitis B transmission and the importance of preventive strategies by our health authorities.

It was noted from this study that predisposing factor for HBV infection such as type of marriage and scarification marks or tattoos did not show a statistical significance.

In general, the increase in ALT, AST and ALP activities in blood are used usually for the detection of hepatocellular damage [50]. Following infection, the immune system attempts to clear the HBV by destroying infected hepatocytes with the consequence that liver enzymes are leaked out into the circulation across the damaged cell membranes [51]. Our findings shows that 73.33%, 60% and 53.33% of samples from HBsAg positive women tested had pathological values of ALAT, ASAT and ALP respectively, thus indicating hepatocellular damage and chronic hepatocellular disease among these patients. Our study equally indicates that none of the pregnant women of our study population was aware about their HBV status and hence failed to seek appropriate medical attention therefore may predispose them to progress to chronic liver disease, cirrhosis and hepatocellular carcinoma as evidenced by the high percent of pathological level of liver enzymes in their blood. This shows a massive

lack of awareness concerning HBV infection in the general Cameroonian population and emphasizes once more the need of community sensitization activities by our health authorities on sensitizing the Cameroonian population about HBV infection, and the importance of anti HBV vaccination.

5. CONCLUSION

Our research findings highlight the fact that HBV is very much present in our community and that the risk of HBV acquisition in our community is high. Our study also shows that pregnant women could serve as an important reservoir to fuel vertical transmission of HBV within our community. Due to the high risk of developing chronic HBV infection among infants born to HBsAg positive mothers, administration of HBIG in combination with hepatitis B vaccine as post-exposure prophylaxis is of paramount importance. Universal free HBsAg screening for all pregnant women and women of child bearing age in Cameroun is advocated.

CONSENT

All subjects gave their informed consent for inclusion before they participated in the study.

ETHICAL APPROVAL

The study has been performed in accordance with the Declaration of Helsinki of 1975 and its later amendments or comparable ethical standards, and the protocol was approved by the National Ethical Committee on human health research in Cameroon (Ethical clearance N^0 2014/03/425/L/CNESRH/SP).

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Uneke CJ, Ogbu O, Inyama PU, Anyanwie GI, Njoku MO, Idoko JH. Prevalence of hepatitis B surface antigen among blood donors and Human immunodeficiency Virus infected patients in Jos, Nigeria. Mem Inst Oswaldo Cruz, Rio de Janeiro. 2005;100(1):13-16.
2. Burnett R, Francois G, Kew G. Hepatitis B Virus and human immunodeficiency virus co-infection in sub-Saharan Africa: a call for further action. Liver Int. 2005;25:201-213.
3. Levy M, Gagnadoux MF. Membranous nephropathy following perinatal transmission of hepatitis B virus infection-long term follow-up study. Pediatr Nephrol. 1996;10(1):76-78.
4. Wasmuth JC. Hepatology, düsseldorf. Flying Publisher. 2009;7-17.
5. Tong S, Kim KH, Chante C, Wands J, Li J. Hepatitis B Virus the antigen variants. Int J Med Sci. 2005;2:2-7.
6. Wolf DC. Viral hepatitis, From e Medicine Specialties> Gastroenterology > Liver. Available:http://emedicine.medscape.com/article/185463-overview (Accessed 08 March 2011)
7. Tran TT. Management of hepatitis B in pregnancy: Weighing the options. Cleveland Clinic J Med. 2009;76:25-29.
8. Beasley RP, Trepo C, Stevens CE, Szmuness W. The e antigen and vertical transmission of hepatitis B surface antigen. Am J Epidemiol. 1977;105:94-8.
9. Wong VC, Ip HM, Reesink HW, Lelie PN, Reerink-Brongers EE, Yeung CY, et al. Prevention of the HBsAg carrier state in newborn infants of mothers who are chronic carriers of HBsAg and HBeAg by administration of hepatitis-B vaccine and hepatitis-B immunoglobulin: Double-blind randomized placebo controlled study. Lancet. 1984;1:921-6.
10. Stevens CE, Toy PT, Tong MJ, Taylor PE, Vyas GN, Nair PV, et al. Perinatal hepatitis B virus transmission in the United States: Prevention by passive-active immunization. JAMA. 1985; 253:1740-5.
11. Hyams KC. Risks of chronicity following acute hepatitis B virus infection: A review. Clin Infect Dis. 1995;20:992-1000.
12. World Health Organization. Hepatitis B. World Health Organization Fact Sheet 204 (Revised October, 2000). Available:http://who.int/inf-fs/en/fact204.html (Accessed 15 October 2012)
13. Shapiro CN. Epidemiology of hepatitis B. Pediatr Infect Dis J. 1993;12:433-7.
14. Andre FE, Zuckerman AJ. Protective efficacy of hepatitis B vaccines in neonates. J Med Virol. 1994;44:144-51.
15. Willis BC, Wortley P, Wang SA, Jacques-Carroll L, Zhang F. Gaps in hospital policies and practices to prevent perinatal

transmission of HBV. Pediatrics. 2010; 125:704-11.
16. Dafallah SE, EL-Agib FH, Bushra GO. Maternal mortality in a teaching hospital in Sudan. Saudi Med J. 2003;24:369-372.
17. World Health Organisation (WHO). Hepatitis B vaccines. Wkly Epidemiol Rec. 2009;84:405-420.
18. Chiaramonte M, Stroffolini T, Ngatchu T, Rapicetta M, Lantum D, Kaptue L, et al. Hepatitis B virus infection in Cameroon: A seroepidemiological survey in city school children. J Med Virol. 1991;33(2):95-99.
19. Mbanya DN, Takam D, Ndumbe PM. Serological findings amongst first-time blood donors in Yaounde, Cameroon: Is safe donation a reality or a myth? Transfus Med. 2003;13(5):267-273.
20. Noah DN, Njouom R, Bonny A, Pirsou P, Meli J, Biwole-Sida M. HBs antigene prevalence in blood donors and the risk of transfusion of hepatitis b at the central hospital of Yaounde, Cameroon. Open Journal of Gastroenterology. 2011;1(2):23-27.
21. Fouelifack FY, Keugoung B, Fouedjio JH, Kouam N, Mendibi S, Dongsta Mabou J. High rates of hepatitis B and C and HIV infections among blood donors in Cameroon: A proposed blood screening algorithm for blood donors in resource-limited settings. Journal of Blood Transfusion. 2012;2012:1-7.
22. Ndumbe PM, Skalsky J, Joller-Jemelka HI. Seroprevalence of hepatitis and HIV infection among rural pregnant women in Cameroon. APMIS. 1994;102(9):662-666.
23. Kfutwah AK, Tejiokem MC, Njouom R. A low proportion of HBeAg among HBsAg-positive pregnant women with known HIV status could suggest low perinatal transmission of HBV in Cameroon. Virol J. 2012;9:62.
24. Fomulu NJ, Morfaw F, Torimiro JN, Nana 1P, Mve VK, Takang W. Prevalence, correlates and pattern of Hepatitis B among antenatal clinic attenders in Yaounde-Cameroon: Is perinatal transmission of HBV neglected in Cameroon? BMC Pregnancy and Childbirth. 2013;13:158.
25. Bounou V. Evaluation socio-economic de l'exploitation agricole des bas-fonds dans les paysanneries de Penka-Michel (Ouest Cameroon). Master Thesis, University of Dschang- Cameroon. French. 2004;2-7.
26. Acquaye JK, Mingle JA. Hepatitis B viral markers in Ghanaian pregnant women. West Afr J Med. 1994;13(3):134-137.
27. Itoua-Ngaporo A, Sapoulou MV, Ibara JR, Iloki LH, Denis F. Prevalence of hepatitis B viral markers in a population of pregnant women in Brazzaville (Congo). J Gynecol Obstet Biol Reprod (Paris). 1995;24(5): 534-536.
28. Hamida EM, Abdul RF, Kheiria EF, Sued EU, Khalifa SG. Maternal and neonatal seroprevalence of Hepatitis B surface antigen (HBsAg) in Tripoli, Libya. J Infect Dev Ctries. 2010;4(3):168-170.
29. Batayneh N, Bdour S. Risk of perinatal transmission of hepatitis B virus in Jordan. Infect Dis Obstet Gynecol. 2002;10:127-32.
30. Luka SA, Ibrahim MB, Iliya SN. Sero-prevalence of Hepatitis B surface antigen among pregnant women attending Ahmadu Bello University Teaching Hospital, Zaria, Nigeria. Nigerian Journal of Parasitology. 2008;29(1):38-41.
31. Eke AC, Eke UA, Okafor CI, Ezebialu IU, Ogbuagu C. Prevalence, correlates and pattern of hepatitis B surface antigen in a low resource setting. Virol J. 2011;8:12.
32. Okoth F, Mbuthia J, Gatheru Z, Murila F, Kanyingi F, Mugo F, et al. Seroprevalence of hepatitis B markers in pregnant women in Kenya. East Afr Med J. 2006;83(9):485-493.
33. Nacro B, Dao B, Dahourou H, Hien F, Charpentier-Gautier L, Meda N, et al. HBs antigen carrier state in pregnant women in Bobo Dioulasso (Burkina Faso). Dakar Med. 2000;45(2):188-190.
34. Madzime S, Adem M, Mahomed K, Woelk GB, Mudzamiri S, Williams MA. Hepatitis B virus infection among pregnant women delivering at Harare Maternity Hospital, Harare Zimbabwe, 1996 to 1997. Cent Afr J Med. 1999;45(8):195-198.
35. Guidozzi F, Schoub BD, Johnson S, Song E. Should pregnant urban south African women be screened for hepatitis B? S Afr Med J. 1993;83(2):103-105.
36. Khalil MKM, Al-Mazrou YY, Al-Jeffri M, Al-Ghamdi YS, Mishkhas A, Bakhsh M, et al. Serosurvey of hepatitis B surface antigen in pregnant Saudi women. Eastern Mediterran Health J. 2005;11:640-47.
37. Vázquez-Martínez JL, Coreño-Juárez MO, Montaño-Estrada LF, Attlan M, Gómez-Dantés H. Seroprevalence of hepatitis B

in pregnant women in Mexico. Salud Publica Mex. 2003;45:165-70.
38. Bart PA, Jacquier P, Zuber PL, Lavanchy D, Frei PC. Seroprevalence of HBV (anti-HBc, HBsAg and anti-HBs) and HDV infections among 9006 women at delivery. Liver. 1996;16(2):110-116.
39. Descos B, Scotto J, Fayol V, Huet JY, Pichoud C, Hermier M, et al. Anti-HBc screening for the prevention of perinatal transmission of hepatitis B virus in France. Infection. 1987;15(6):434-439.
40. Ding Y, Sheng Q, Ma L, Dou X. Chronic HBV infection among pregnant women and their infants in Shenyang, China. Virol J. 2013;10(17):1-5.
41. Del Canho R, Grosheide PM, Mazel JA, Heijtink RA, Hop WC, Gerards LJ, et al. Ten-year neonatal hepatitis B vaccination program, The Netherlands, 1982–1992: protective efficacy and long-term immunogenicity. Vaccine. 1997; 15(15):1624-1630.
42. Wang Z, Zhang J, Yang H, Li X, Wen S, Guo Y, et al. Quantitative analysis of HBV DNA level and HBeAg titer in hepatitis B surface antigen positive mothers and their babies: HBeAg passage through the placenta and the rate of decay in babies. J Med Virol. 2003;71(3):360-366.
43. Mortada ES, Mohamed FM, Mona SEDH, Mohamed E, Shaimaa SK, Hanaa EK. Prevalence of Hepatitis B Virus Infection among Egyptian Pregnant Women-A Single Center Study. International Journal of Tropical Disease & Health. 2013;3(2): 157-168.
44. Habiba SA, Memon MA. Prevalence of Hepatitis B infection in pregnant women in a tertiary care hospital. Infectious Disease Journal of Pakistan. 2007;35-38.
45. Taseer IU, Ishaq F, Hussain L, Safdar S, Mirbahar AM, Faiz SA. Frequency of anti-HCV, HBsAg and related risk factors in pregnant women at Nishtar Hospital, Multan. J Ayub Med Coll Abbottabad. 2010;22:13-16.
46. Azhar T, Khan IA, Mohsein S, Usman J. Antenatal screening for hepatitis B and C virus infection in pregnant women in a tertiary care hospital of Rawalpindi. 2011; 61(3):470-473.
Available:http://www.pafmj.org
47. Pennap GR, Osanga ET, Ubam A. Seroprevalence of hepatitis B surface antigen among pregnant women attending antenatal clinic in Federal Medical Center, Keffi, Nigeria. Res. J. Med. Sci. 2011; 51(2):80-82.
48. Nuchprayoon T, Chumnijarakij T. Risk factors for hepatitis B carrier status among blood donors of the national blood center, thai red cross society. Southeast Asian J Trop Med Public Health. 1992;23:246-253.
49. Shahnaz S, Reza B, Seyed-Moayed A. Risk factors for chronic Hepatitis B infection: A case controlled study. Hepat Mon. 2005;5(4):109-115.
50. Whitby LG, Percy IW, Smith AF. Lecture notes on clinical chemistry: Clinical enzymology. In Bllackwell Scientific Publications, Third Edition, Chapter 8 Oxford, London. 1978;122-141.
51. Moss DW, Henderson AR. Enzymes. Burtis CA, Ashwood ER (Eds). In: Tiets textbook of clinical chemistry. Third edition, Chapter 20, WSaunders Company Philadelphia. 1999.788-793.

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle3.com/review-history/33102

.