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Seroprevalence, Importance of Rapid Testing and Factors Associated with HBsAg Carriage in Pregnancy in Three Referral Maternity Hospitals in Mono (Benin), in 2020

Aboudou Raïmi Kpossou[1,2*], Djima Patrice Dangbemey[1,3], Véronique Mèdessè Tognifodé[1,3], Barnard Acakpo[3], Jean Sehonou[1,2], Josiane Angeline Tonato Bagnan[1,3]

[1]Faculty of Health Sciences, University of Abomey-Calavi, Cotonou, Republic of Benin
[2]Hepato-Gastroenterology Department, National and University Hospital Hubert Koutoukou Maga (CNHU-HKM), Cotonou, Republic of Benin
[3]Obstetrics Gynecology Department, Lagune Mother-Child University Hospital Center (CHU MEL), Cotonou, Republic of Benin
Email: *kpossou.raimi@yahoo.fr.

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Abstract

Introduction Difficulties in accessing the screening test for viral hepatitis B in maternity wards could be a factor in underestimating the prevalence of anti-HBV antibodies. The rapid diagnostic orientation test (RDOT) could improve seroprevalence and obstetrical prognosis. The aim of this study was to use the rapid diagnostic orientation test (RDOT) to determine the seroprevalence of HBs antigen carriage in pregnant women while highlighting the associated factors. **Methods** This was a cross-sectional and descriptive study that took place from October to December 2020 (three months) in three (03) reference maternities in western Benin (Mono). Consenting pregnant women received in prenatal consultation had been screened by RDOT. Positive cases were confirmed by ELISA test. The follow-up of these cases made it possible to establish the obstetrical prognosis. **Results** Of 201 women studied, 11 (5.5%) were positive for RDOT HBV and confirmed by the ELISA test. The factors associated with HBsAg carriage during pregnancy were multiple sexual partnerships (p = 0.01), female circumcision (p = 0.0001), and ignorance of prior HBV serological status (p = 0.0001). No influence of hepatitis B on pregnancy was noted. **Conclusion** The seroprevalence of hepatitis B in pregnancy was intermediate in the reference maternities of western Benin. The associated factors were multiple sexual partnerships, female circumcision and unawareness of prior HBV status. Free RDOT in maternity wards would improve early detection and management of viral hepatitis B in pregnancy.

Keywords

Hepatitis B, Seroprevalence, Associated Factors, Rapid Test, Benin

1. Introduction

Viral hepatitis is an infectious disease that causes a greater number of deaths worldwide compared to mortality due to tuberculosis or the human immunodeficiency virus (HIV). Indeed, in 2019, they caused around 820,000 deaths. These deaths are mainly due to cirrhosis or hepatocellular carcinoma [1]. According to the latest epidemiological estimates from the World Health Organization (WHO), 296 million people were living with chronic hepatitis B in 2019 and 1.5 million new infections are detected each year [1] [2]. Mother-to-child transmission of the hepatitis B virus (HBV) remains a major cause of the maintenance of HBV endemic in the world despite the availability of an effective vaccine against this virus for more than 25 years [3]. In order to reduce maternal and fetal morbidity linked to infection with the hepatitis B and C viruses, the World Health Organization (WHO) proposes systematic screening for hepatitis B (HBsAg) in course of pregnancy. But HBV screening tests are not always accessible to all pregnant women in all localities in Benin due to lack of financial resources. The rapid screening test for hepatitis B and C viruses could be an opportunity to reduce the prevalence, and improve the diagnosis and management of these infections in pregnancy. It should be remembered that there are data on the prevalence of HBV in pregnant women in certain departments of Benin such as Littoral and Borgou. However, there is still no data on the subject in the Mono. For these reasons, this study was conducted to assess the impact of a free rapid diagnostic orientation test for hepatitis B virus infection on seroprevalence and factors associated with HBsAg carriage by pregnant women in reference maternities in western Benin (Mono). This will then make it possible to generalize it to the whole country and would contribute to having a real idea of HBV and HCV infections during pregnancy.

2. Methods

This was a descriptive cross-sectional study with prospective data collection. It took place from October 5 to December 31, 2020 (3 months) in the prenatal consultation services (PCS) of the maternities of the Departmental Hospital Center (DHC) of Mono, the zone hospital (ZH) of Lokossa and the municipal health center of Athiémé. The study population consisted of pregnant women received in PCS.

The inclusion criteria were: pregnant woman, prenatal follow-up carried out in one of the maternities hosting this study and having given her consent to participate in the study.

Exclusion criteria were breach of consent and invalid rapid HBV tests (no red

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Sampling was non-probability with systematic listing of all eligible pregnant women according to the inclusion criteria. The sample size N was determined by the Schwartz formula:

$$N = \frac{\varepsilon^2 pq}{i^2},$$

With

N: the calculated sample size;

ε = 1.96 (value at 5% risk);

i = 5% (margin of error);

p = baseline prevalence of HBV infection in pregnant women;

q = 1 − *p*.

Determination of N: considering the prevalence of HBV which was 14% at the University Clinic of Gynecology-Obstetrics (CUGO) in 2017 by Kpossou *et al.* [4]. $N = \frac{1.96^2 \times 0.14 \times 0.86}{0.05^2} = 185.011456$. Thus 201 pregnant women constituted the representative population for this study.

The HBV rapid test (Micropoint®) used in our study was made in China in April 2014 by Micropoint. The sensitivity and specificity displayed by the leaflet was 98.4% with an expiry date of April 2022.

The dependent variable was HBsAg carriage defined by a positive rapid screening test and confirmed by the Enzyme Linked Immuno-Sorbent Assay serology (ELISA Intec HBsAg®). The independent variables were the sociodemographic and clinical characteristics of pregnant women carrying viral hepatitis B and the therapeutic and prognostic aspects of this infection on pregnancy.

The pregnant women were received in turn in a room where they were alone with the interviewer. After the information on the subject, the consent of the pregnant woman was collected before carrying out the pre-test counseling. Then, the hepatitis B screening test was performed with the RDOT and the result was immediately communicated to each participant before the post-test counselling. In pregnant women screened for HBsAg positive, a search for HBV-HCV and HBV-HIV co-infection was also carried out during confirmation by ELISA test. In addition, cases detected positive for HBsAg were referred for specialized care by a hepato-gastroenterologist.

Data collection was done using KoBoCollect on the basis of an elaborate and validated survey form. The questionnaire used was designed by the authors themselves. It contained 85 questions including general information, gynecological and obstetric history, medicosurgical history, social survey, clinical signs, information about current pregnancy and serological markers (see **Appendix**). Data collection was carried out by four (04) investigators (medical students) including the principal investigator in collaboration with the midwives of the various maternities concerned.

Data processing and analysis were done with EPI INFO software version 7.2.1.0. The graphs and tables were designed with EXCEL 2013, the quantitative

variables were presented in mean, median, standard deviation then the qualitative variables in frequencies or percentages. The chi2 test was used to determine the associations between the different variables, with a significance level of 5%.

The study was carried out in strict compliance with ethical standards and rules of ethics. Thus we have received written authorization from the local Ethics Committee for Biomedical Research of the University of Parakou (Ref: 0483/CLERB-UP/P/SP/R/SA) and from the Departmental Director of Health of the Mono. Then we explained the purpose, nature and scope of the study, the procedure for recruiting pregnant women and collecting data from doctors, gynecologists and midwives. Data collection was carried out under conditions respecting basic measures in terms of confidentiality of the information obtained and the results of the tests that were carried out. The tests were anonymous. The questionnaires and the samples were identified only by a code that will not allow the identification of the pregnant woman who agreed to participate in the study. This number was used to link the various pieces of information.

In addition, it should be noted that in this study, women who had never given birth were considered nulliparous. The primiparous are women who have had a single birth before this study, the pauciparous are women who gave birth at least three (02) times before the study. Multiparas are considered by women who have given birth four (04) times. Grand multiparas are pregnant women whose number of deliveries is greater than or equal to five (05).

3. Results

3.1. Sociodemographic Characteristics

❖ **Sample size**

We studied 201 pregnant women in three referral maternity hospitals.

❖ **Age**

The average age was 27.7 ± 5.4 years with extremes of 15 and 45 years. The modal age group was 25 to 29 years old.

❖ **Education level**

A good proportion (81.6%, n = 164) of pregnant women surveyed were educated and 50.8% had at least secondary education (**Figure 1**).

❖ **Occupation**

In this study population, 88.6% (n = 178) of the pregnant women surveyed were non-civil servants and therefore had no fixed monthly income (**Table 1**). Other occupations were: secretary, nurse's assistant, computer scientist, pharmacy assistant, laboratory biologist, missionary and photographer.

❖ **Marital status**

Life as a couple in a monogamous regime was the most represented with a proportion of 75.6% (n = 152). It is followed by life as a couple in a polygamous regime, *i.e.* a proportion of 20.9% (n = 42). Then come single people with a proportion of 3% (n = 6) and finally only one pregnant woman was widowed in this study.

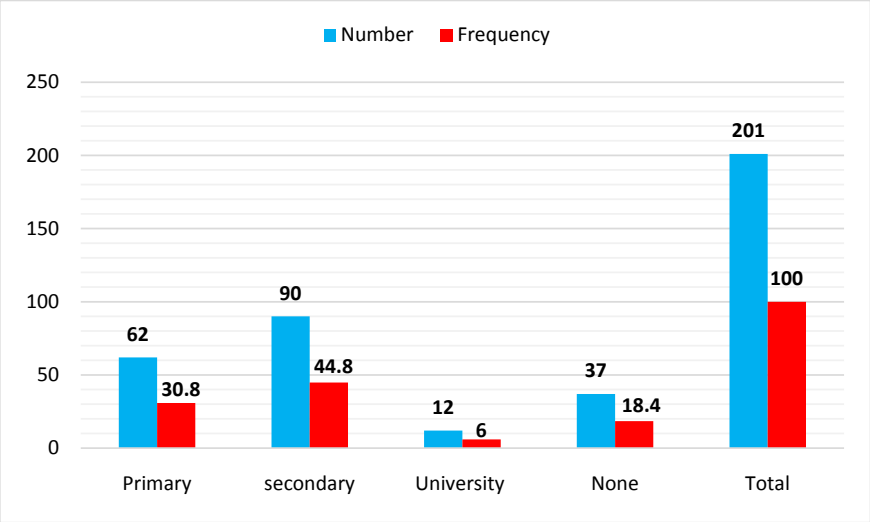

Figure 1. Distribution of pregnant women attending the Lokossa Athiémé reference maternity units in 2020, by level of education.

Table 1. Distribution of pregnant women attended in the Lokossa-Athiémé reference maternity units in 2020 according to their occupation.

Occupation	Effectif (n)	Frequency (%)
Reseller/trader	78	38.8
Worker/artisan	61	30.3
Housewife	36	17.9
Farmer	7	3.5
Teacher	5	2.5
Pupil/student	4	2.0
Other	10	5.0
Total	**201**	**100.0**

3.2. Clinical Features

❖ **Gyneco-obstetric history**

➢ **Parity**

The pauciparous were the most represented in our series in a proportion of 38.8% (n = 78). They were followed by nulliparous 24.9% (n = 50). Primiparous represented the third strongest proportion 24.4% (n = 49). Multiparous and grand multiparous are the least represented with a respective proportion of 11.4% (n = 23) and 0.5% (n = 1).

➢ **Number of living children**

In this series, 73.6% (n = 148) of pregnant women had at least one living child versus 26.4% (n = 53) who had none.

➢ **Other gyneco-obstetric history**

More than half 52.7% (n = 106) had no gyneco-obstetric history among pregnant women. Spontaneous miscarriages were noted in 22.9% (n = 46) of preg-

nant women surveyed. Caesarean section, hypertension on pregnancy, induced miscarriages, threats of premature delivery were mentioned respectively by 17.4% (n = 35), 4.5% (n = 9), 2% (n = 4) and 0.5% (n = 1).

❖ **Medical and surgical history**

Morbid antecedents were observed in 5% (n = 10) of pregnant women surveyed. These were sickle cell anemia (1.5%, n = 3), hypertension (2.5%, n = 5), hemophilia (0.5%, n = 1) and others (0.5%, n = 1). Almost all pregnant women and their partners did not know their HBV serological status in a respective proportion of 98% (n = 99) and 92% (n = 185) and HCV with a respective proportion of 100% (n = 201) and 91.5% (n = 184). Most of the pregnant 99% (n = 199) were therefore not vaccinated against the hepatitis B virus.

❖ **Social survey**

➢ **Number of known sexual partners in life**

More than half of pregnant women 59.2% (n = 119) had known at least two sexual partners (Figure 2).

➢ **Other risk factors for HBV**

Acts leading to skin invasion such as piercings and scarifications were the main other risk factors found (Table 2).

❖ **Clinical signs**

The most common symptoms encountered during this study were physical asthenia (51.2% n = 103), anorexia (23.4%, n = 47), fever (10%, n = 20), arthralgia (8.5%, n = 17), jaundice (2%, n = 4) and purpura (0.5% n = 1). The other symptoms were represented by headaches, abdominal pain, dyspnoea, undocumented epigastralgia: and were present in 5.9% (n = 12) of pregnant women.

➢ **Number of antenatal consultations (ANC) carried out**

In the study, only 46.3% (n = 93) of pregnant women had performed at least three ANC during their pregnancy. The majority (53.7%, n = 108) performed less than three ANC.

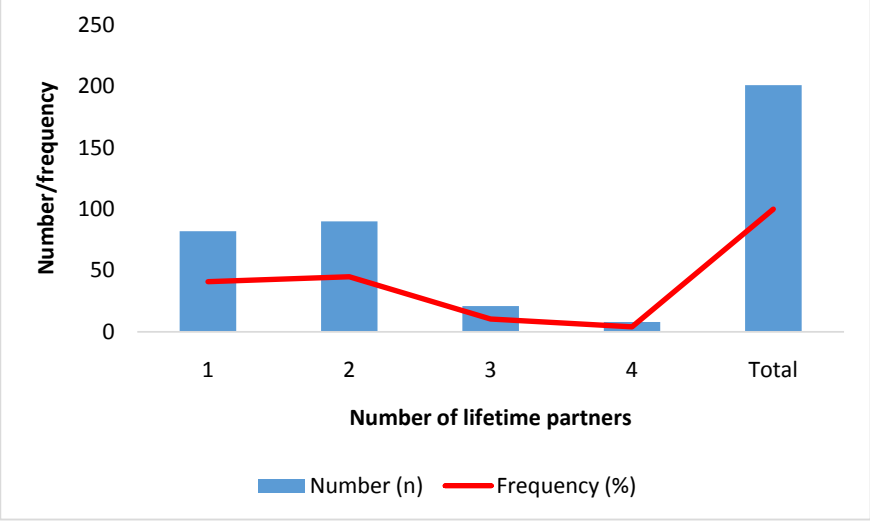

Figure 2. Distribution of pregnant women monitored in the Lokossa Athiémé reference maternity units in 2020 according to the number of sexual partners.

Table 2. Distribution of pregnant women monitored in the Lokossa-Athiémé reference maternity units in 2020 according to other risk factors.

Autres facteurs de risque	Effectif (n)	Fréquence (%)
Piercing	194	96.5
Scars	108	53.7
Alcohol consumption	89	44.3
Manicure using shared equipment	76	37.8
Sexually transmitted infection	44	21.9
Dental care	13	6.5
Tattoo	7	3.5
History of excision	3	1.5
Acupuncture	1	0.5

3.3. Paraclinic Features

Only 11.9% of the respondents carried out hepatitis B serology as part of the prenatal follow-up, before inclusion in the study. The other prenatal check-ups carried out by pregnant women were: Rhesus blood grouping (36.3%, n = 73), hemoglobin electrophoresis (14.9%, n = 30), syphilitic serology (13.4%, n = 27), obstetric ultrasound (54.2%, n = 109) and HIV serology (100%, n = 201).

3.4. Seroprevalence of Hepatitis B and Co-Infections with HCV and HIV in the Reference Maternity Wards of Lokossa-Athiémé in 2020

❖ **Seroprevalence of hepatite B in pregnancy**

The seroprevalence of HBsAg in pregnancy in this study was 5.5% (11/201). The pregnant women who tested positive for RDOT Ag HBs were all confirmed by the ELISA test.

❖ **Co-infection HBV-HCV et HBV-HIV**

No HBV-HCV co-infection was detected. Similarly, no HBV-HIV co-infection was recorded during this study.

3.5. Factors Associated with Hepatitis B Virus Infections

Sociodemographic factors such as age, educational level, and occupation were not associated with HBV infection. Thus, of HBV-positive pregnant women, 45.4% (n = 5) were housewives, 36.4% (n = 4) were resellers, 18.2% (n = 2) were craft workers. But these results obtained do not show any significant association (p = 0.36) between the profession and the carriage of the HBs antigen during pregnancy in this study.

History such as parity, history of miscarriage and threat of childbirth were also not associated with HBV infection in this study (Table 3).

Among the pregnant women screened positive for HBV, four were aware of their previous HBV serological status, only one of whom was following tradi-

tional treatment. The other three were not on any treatment. None of them had any particular medical and surgical history and had never been vaccinated against HBV. Ignorance of serological status was associated with HBV infection during pregnancy (p = 0.0001) (Table 3).

The number of lifetime sexual partners (p = 0.01) and the practice of excision (p = 0.0001) were associated with HBV infection during pregnancy (Table 3).

The results obtained showed no significant influence of hepatitis B on pregnancy in this study.

Table 3. Factors associated with HBsAg carriage during pregnancy.

Medical/surgical history	HBV		
	Negative	Positive	p
Previous HBV serological status of the pregnant woman			
Unknown	163	7	**0.0001***
Negative	27	0	
Positive	0	4	
Previous HIV serological status of the pregnant woman			
Unknown	13	1	0.34
Negative	174	10	
Positive	3	0	
Previous HBV vaccination			
No	188	11	0.5
Yes	2	0	
Partner's HBV serological status			
Unknown	176	9	0.4
Negative	14	2	
Number of sexual partners in life			
1	79	3	**0.01***
2	86	4	
3	18	3	
4	7	1	
Sexually transmitted infections (gonorrhoea, chlamydia or syphilis)			
No	150	7	0.37
Yes	40	4	
Manucure using shared equipment			
No	121	4	0.48
Yes	69	7	
Scars			
No	89	4	0.79
Yes	101	7	

Continued

Piercing			
No	6	1	0.8
Yes	184	10	
Excision			
No	188	10	**0.0001***
Yes	2	1	
Bleeding in pregnancy			
No	180	11	0.69
Yes	10	0	
Water loss			
No	188	10	0.1
Yes	2	1	
Lumbopelvic pain			
No	126	7	0.58
Yes	64	4	

4. Discussion

In this study, the seroprevalence of viral hepatitis B in pregnant women was 5.5%. Among blood donors, it was estimated at 6.3% in 2011 according to surveys conducted by Kodjoh *et al.*, which classified the Mono department in the WHO intermediate zone (prevalence between 2% - 7%) [5]. This result is similar to those of Kouakou *et al.* [6] who noted in a referral hospital in Ivory Coast in 2017 a seroprevalence of 5.4% and Fiacre *et al.* [7] who reported a prevalence of 6.1% in Cameroon in 2019. In 2017 Alassan *et al.* [8] found a hepatitis B seroprevalence of 14.02% among pregnant women in Parakou in northern Benin. Similarly, Kpossou *et al.* [4] reported 14% HBV on pregnancy in 2017 in Cotonou. This difference could be explained by the fact that Kpossou *et al.* and Alassan *et al.* had carried out their study respectively in the departments of Littoral and Borgou which are classified among the high prevalence areas of the WHO (prevalence > 8) according to Kodjoh *et al.* in 2013 [9].

The average age was 27.7 ± 5.4 years with the extremes of 15 and 45 years in the study. This result is similar to that of De Paschale *et al.* [10] who reported an average age of 26.2 years with extremes ranging from 15 to 41 years in northern Benin in 2014. Similarly, in Morocco, Sbiti *et al.* [11] found in 2016 a mean age of 28 ± 6 years with extremes ranging from 17 to 43 years. In Mali, in the obstetrics gynecology department of the CHU Gabriel Touré in 2020, an average age of pregnant women of 26.9 ± 5.6 years with extremes of 18 and 43 years had been found by Traoré [12]. In Benin, at the University Clinic of Gynecology and Obstetrics (CUGO) of the CNHU-HKM in 2017, an average age of 30 ± 5 years with extremes of 30 to 35 years was noted [4]. This age difference could be ex-

plained by the fact that women marry at a young age in Mono according to the 2015 social dashboard [13].

Zeba *et al.* [14] in 2009 in Ouagadougou found a predominance of educated pregnant women in the proportions of 91.7%. This study also found a predominance of pregnant women attending school (81.4%). This result could be explained by the fact that the study was carried out in urban or peri-urban communes where young women are more likely to be educated.

The majority of pregnant women in the study were resellers or traders (38.8%), workers or artisans (30.3%) and housewives (16%). Ousmane *et al.* [15] found in 2016 in Niger that the majority of pregnant women were housewives (85%) and civil servants (12%). Similar studies carried out in Cotonou found mostly civil servants [4] [10]. This difference is explained by the fact that our study took place in an agricultural area where women are more involved in trade and crafts, whereas those mentioned were carried out in the city of Benin's economic capital, where fixed monthly income activities predominate (public and private sectors).

Among the pregnant women in this study, 96.5% were married. This result is identical to those of Ejeta *et al.* [16] in Ethiopia in 2014 who reported 96.4% of pregnant women married. De Paschale *et al.* [13] in 2014 in Tanguiéta found a similar proportion (95%). These high proportions of pregnant women in a couple could be due to the fact that in African culture pregnancy is frowned upon outside of couple's life.

Some studies have shown an influence of hepatitis B on pregnancy. This is the case of Sirilert *et al.* [17] in Thailand in 2012 who reported that there is a slightly increased risk of premature birth and low birth weight linked to the carriage of HBsAg during pregnancy. Cai *et al.* [18] in 2015 in China noted that chronic HBV infection during pregnancy may increase the risk of intrahepatic cholestasis of pregnancy and premature rupture of membranes. This is not the case in the study. Most studies of the sub-region have come to the same result as ours [6] [10] [17]. The discordance of the results could be explained by the fact that most of the studies which show an association between viral hepatitis B and pregnancy are carried out in Asian countries and the correspondence with other populations must remain cautious.

The 11 pregnant women who tested positive for RDOT underwent an ELISA test which confirmed the presence of HBsAg in all cases. In the study by Kpossou *et al.* on 23 pregnant women screened positive by the rapid diagnostic orientation test, the confirmation ELISA serology was also positive for the 23 cases [4]. The same is true for Alassan *et al.* where all the cases positive to the rapid diagnostic test were confirmed by the ELISA method [8]. It can therefore be concluded that RDOT has an important advantage in the detection of a considerable number of cases of viral hepatitis B in pregnancy. However, from a comparative study between rapid tests and ELISA (the reference method) carried out in Nigeria in 2019 by Abulude *et al.* [19], it appears that ELISA was slightly

superior because 02 negative cases with the rapid test were positive by ELISA. We can therefore remember that, when the RDOT is negative, the pregnant woman must be informed of the limits of the test and therefore of the possibility of carrying out a reference examination from a blood sample.

The most affected age group was 30 to 34 years old and age was not associated with HBsAg carriage during pregnancy in this study. Fouelifack *et al.* [20] in Cameroon in 2016 reported that pregnant women aged 30 to 34 were significantly more infected with HBV (OR = 2; 95% CI: 1.82 - 2.05). Similarly Luuse *et al.* [21] found in Ghana in 2016 that the most affected age group was 15 - 20 years with a statistically significant association ($p < 0.001$). The young age observed in these studies and ours could be explained by the fact that the transmission of HBV in our regions remains mainly perinatal.

The pregnant women most exposed to carrying were resellers (n = 4), craft workers (n = 2). All these socio-demographic factors were not associated with HBV infection during pregnancy in this series. A study carried out in northern Benin in 2017 noted no significant association between sociodemographic factors [age ($p = 0.909$)], marital status ($p = 0.880$), level of education ($p = 0.749$), socio-professional status ($p = 0.329$), monthly income ($p = 0.160$)] and HBsAg carriage [8]. This is not the case with Bigot *et al.* [22] in 1989 in Cotonou (Benin) who reported in their series that women positive for HBsAg came from low socioeconomic strata. Sidibe *et al.* [23] found a high percentage of multigravidae (76%) and multiparous (75.1%) in HBV-positive pregnant women. A study carried out in southern Benin in 2017 also noted the dominance of multigravidae (90%) and multiparous (86.6%) [4]. Furthermore, these studies did not show any association between parity and HBsAg carriage. Similar observations were made in our study, with the predominance of paucigravidae (n = 4), multigravidae (n = 4) and pauciparous (n = 6); moreover, gestality and parity were not significantly associated with HBV. Ngaira *et al.* in Kenya [24] in 2014 noted that multiparous were the most exposed with a significant association between parity and HBsAg carriage during pregnancy.

Ignorance by pregnant women of their previous HBV serological status could lead to neglect of means of prevention, thus exposing them to the risk of contamination. This is clearly found in our study with only 4/201 (2%) of pregnant women knowing that they are HBsAg carriers and 84.6% of pregnant women surveyed unaware of their previous serological status. Unawareness of prior HBV serological status was significantly ($p = 0.0001$) associated with HBsAg carriage during pregnancy in our study. The same result was found in Benin in the University Clinic of Gynecology and Obstetrics of the National and University Hospital Hubert Koutoukou Maga in 2017 [4], knowledge of a previously positive HBV serology was associated with carrying of HBsAg in pregnant women in this study. Thus, among pregnant women with no knowledge of their previous HBV serological status, 10.3% (n = 13) had a positive HBV test and 89.2% (n = 107) pregnant women were negative for HBV with a p value = 0.01.

Vaccination of women of childbearing age is one of the major pillars of the prevention of vertical transmission of HBV. In this study, only 02 pregnant women, *i.e.* a proportion of 1%, were vaccinated against the hepatitis B virus and none of the HBV positive pregnant women was. This result is similar to that reported in Morocco in 2014 with a rate of 2.4% of pregnant women having been vaccinated [11]. The same observation was made by Ousmane *et al.* [15] in 2016 in Niger. They reported that none of the women surveyed had been vaccinated against the hepatitis B virus. It appears that new vaccination strategies must be introduced in order to improve HBV vaccination coverage in Africa in general and in Benin in particular.

In this study, 4% of our pregnant women with several sexual partners had positive serology and this result was significant. Yohanes *et al.* [25] reported a much higher rate of 16.7% ($p = 0.04$) of pregnant women having known several sexual partners. Fouelifack *et al.* [20] found that multiple sexual partners were significantly associated with hepatitis B infection (OR = 11.47; 95% CI: 5.11 - 25.74). This result is logical given that multiple sexual partnerships promote the dissemination of HBV and it is urgent to take measures to raise awareness about the transmission of hepatitis B. However, this conclusion remains to be put into perspective because the transmission of HBV in our country is especially perinatal.

The practice of female circumcision is one of the African practices carried out under precarious aseptic conditions. In the study, a pregnant woman who tested positive for RDOT Ag HBs had been excised. This result was significantly associated with HBsAg carriage during pregnancy. Murad *et al.* [26] came to the same result, reporting a significant association of excision with HBsAg seropositivity (OR = 3.3, 95% CI: 1.1 - 10.2; $p = 0.03$). Alassan *et al.* [8], on the other hand, had not noted any significant association between excision and HBsAg positivity.

We found no association between HBsAg carriage and manicure or pedicure with common material ($p = 0.48$), tattoos ($p = 0.94$), scarification ($p = 0.79$), piercings ($p = 0.8$), acupuncture ($p = 0.96$), treatments ($p = 0.61$) and digestive endoscopies ($p = 0.96$). It is the same finding in Ousmane *et al.* [15] who had noted no significant association between the carriage of HBsAg during pregnancy with dental care, tattoos and piercings. Some authors have found associations between these risk factors and HBsAg carriage in pregnant women. This is the case of Mve Koh [27] in Cameroon in 2018 who reported an association between dental care [OR: 2.4, 95% CI (2.26 - 4.96), $p = 0.01$]; scarifications [OR 7.4 95% CI (3.77 - 14.58) $p < 0.01$] and HBsAg carriage during pregnancy. The discrepancy in the results could be explained by the fact that these traditional practices are increasingly carried out under better hygienic conditions.

This study provides useful information for the fight against hepatitis B in Benin. Currently, screening for hepatitis B is not free for pregnant women in all maternity hospitals in Benin. However, since 2005, vaccination against HBV has

been applied to all infants as part of the expanded vaccination program and since 2020 a dose within 24 hours of birth has been administered to newborns throughout Benin.

The limitation of this work is not having systematically carried out the ELISA test at the same time as the TROD for the screening of HBs Ag in order to prove the reliability of the use of the TROD. This limitation is essentially linked to the fact that the study was not funded.

5. Conclusion

Screening for viral hepatitis B during pregnancy is not often carried out in maternity wards in western Benin. It was easy, thanks to the rapid diagnostic orientation test which had made it possible to find an intermediate prevalence of HBsAg in pregnant women according to the WHO classification. The factors associated with the carriage of HBsAg during pregnancy were multiple sexual partnerships, excision and ignorance of the serological status prior to HBV. This study did not show that there is a link between obstetric complications and the carriage of the HBS antigen. Setting up free HBV screening by RDOT in pregnant women in all maternity hospitals in Benin would be useful to contribute to the eradication of HBV in Benin.

Authors' Contributions

All authors participated in the active writing and editing of the article. All authors read and approved the final version of the manuscript.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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Appendix

QUESTIONNAIRE

"VIRAL HEPATITIS B AND C IN PREGNANCY IN THREE REFERENCE MATERNITIES IN THE LOKOSSA-ATHIEME HEALTH ZONE IN 2020"

File number: [___] [___] [___] Date:

No	Questions	Answer codes	
	I. GENERAL INFORMATION		
Q01.	Patient code	[___][___][___][___]	
Q02.	Age	[_____]	
Q03.	Religion	Christian = 1 Muslim = 2 Animist = 3 Other = 4 None = 5	[___]
Q04.	Level of study	None = 1 Primary = 2 Secondary = 3 University = 4	[___]
Q05.	Marital status	Single = 1 Married monogamous = 2 Married polygamous = 3 Divorced/widowed = 4 Not concerned = 5	[___]
Q06.	Nationality	Beninese = 1 Other = 2	[___]
Q07.	If beninese, specify ethnicity		
Q08.	Municipality of origin	Lokossa = 1; Athieme = 2 Come = 3 Grand-Popo = 4 Houeyogbe = 5 Bopa = 6 Other = 7 (specify)	
Q09.	Profession	Teacher = 1 Reseller/merchant = 2 Worker/artisan = 3 Farmer = 4 Student = 5 None = 6 Other = 7(to be specified)	[___]
Q10.	Place of residence	Lokossa = 1 Athieme = 2 Come = 3 Grand-Popo = 4 Houeyogbe = 5 Bopa = 6 Other = 7(to be specified)	[___]

Continued

II. OBSTETRIC GYNECOLOGICAL HISTORY			
Q11.	Gesity		[___]
Q12.	Parity		[___]
Q13	Number of living children		[___]
Q14	Spontaneous miscarriages	Yes = 1 No = 2	[___]
Q15.	Induced miscarriages	Yes = 1 No = 2	[___]
Q16	High blood pressure in pregnancy	Yes = 1 No = 2	[___]
Q17	Threat of premature birth	Yes = 1 No = 2	[___]
Q18	Ceasarean	Yes = 1 No = 2	[___] Specify the number…
III. MEDICO-SURGICAL HISTORY			
Q19.	High blood pressure	Yes = 1 No = 2	[___]
Q20.	Diabetes	Yes = 1 No = 2	[___]
Q21.	Sickle cell disease	Yes = 1 No = 2	[___]
Q22.	Haemophilia	Yes = 1 No = 2	[___]
Q23.	Other previous liver pathology	Yes = 1 No = 2	[___]
Q24.	Surgery	Yes = 1 No = 2	[___] Specify type of surgery
Q25.	Blood transfusion	Yes = 1 No = 2	[___]
	Dialysis	Yes = 1 No = 2	[___]
Q26.	Previous liver pathology	Yes = 1 No = 2	[___]
Q27.	Previous HBV serological status of the pregnant woman	Positive = 1 Negative = 2 Unknown = 3	[___]
Q28	If HBV positive (If not go to Q30)	Drug treatment = 1 Traditional treatment = 2 No treatment = 3	[___]
Q29	HBV viral load	Known = 1 Unknown = 2	[___] Specify the value if known:……
Q29.	Previous HCV serological status of the pregnant woman	Positive = 1 Negative = 2 Unknown = 3	[___]
Q30	Si VHC positif, Si non passer au Q32	Drug treatment = 1 Traditional treatment = 2 No treatment = 3	[___]

Continued

Q31	HCV viral load	Known = 1 Unknown = 2	[___] Specify the value if known:……
Q32.	Prior serological status to HDV of the pregnant woman	Positive = 1 Negative = 2 Unknown = 3	[___]
Q33.	Previous HIV serological status of the pregnant woman	Positive = 1 Negative = 2 Unknown = 3	[___]
Q34.	Previous HBV vaccination	Yes = 1 No = 2	[___]
Q35.	HBV serological status of partner	Positive = 1 Negative = 2 Unknown = 3	[___]
Q36.	HCV serological status of partner	Positive = 1 Negative = 2 Unknown = 3	[___]
Q37	HIV serological status of partner	Positive = 1 Negative = 2 Unknown = 3	[___]
Q38	Hepatitis C in those around you	Positive = 1 Negative = 2 Unknown = 3	[___]
IV. SOCIAL SURVEY			
Q39.	Do you use drugs by injection?	Yes = 1 No = 2	[___]
Q40.	Do you consume alcohol?	Yes = 1 No = 2	[___]
Q41.	How many sexual partners have you had in your life?	Yes = 1 No = 2	[___]
Q42.	Have you ever suffered from a sexually transmitted infection (gonococcal disease, chlamydia or syphilis)?	Yes = 1 No = 2	[___]
Q43.	Did you do manicure using common equipment?	Yes = 1 No = 2	[___]
Q44.	Do you have a tattoo?	Yes = 1 No = 2	[___]
Q45.	Do you have scarifications?	Yes = 1 No = 2	[___]
Q46.	Do you have a piercing?	Yes = 1 No = 2	[___]
Q47.	Have you ever had to do an acupuncture session?	Yes = 1 No = 2	[___]
Q48	Have you been circumcised?	Yes = 1 No = 2	[___]
Q49.	Have you ever had to have dental work done?	Yes = 1 No = 2	[___]

Continued

Q50.	Have you ever had to do a digestive endoscopy?	Yes = 1 No = 2	[___]
Q51	Have you ever had to do a digestive endoscopy?	Yes = 1 No = 2	[___]
V. CLINICAL SIGNS			
Q52	Anorexia	Yes = 1 No = 2	[___]
Q53	Asthenia	Yes = 1 No = 2	[___]
Q54	Fever	Yes = 1 No = 2	[___]
Q55	Polydipsia	Yes = 1 No = 2	[___]
Q56	Polyuria	Yes = 1 No = 2	[___]
Q57	Jaundice	Yes = 1 No = 2	[___]
Q58	Purpura	Yes = 1 No = 2	[___]
Q59	Arthralgia	Yes = 1 No = 2	[___]
Q60	Others	Yes = 1 No = 2	[___] To be specified
Q61.	Data from today's physical examination (obstetric+++)		
VI. Information about current pregnancy			
Q62	Age de la grossesse	First trimester = 1 Second trimester = 2 Third trimester = 3	[___]
Q63	Pre-natal consultation	3< = 1 [3; 5[= 2 >5 = 3	[___]
Q64	Obstetric ultrasound	Yes = 1 No = 2	[___]
Q65	Blood group and Rhesus	Yes = 1 No = 2	[___]
Q66	Hemoglobin electrophoresis	Yes = 1 No = 2	[___]
Q67	HBsAg	Yes = 1 No = 2	[___]
Q68	Anti-HCV antibodies	Yes = 1 No = 2	[___]
Q69	HIV serology	Yes = 1 No = 2	[___]
Q70	Toxoplasmosis serology	Yes = 1 No = 2	[___]
Q71	Rubella serology	Yes = 1 No = 2	[___]
Q72	TPHA-VDRL	Yes = 1 No = 2	[___]

Continued

Q73	Bleeding during pregnancy	Yes = 1 No = 2	[___]
Q74	Breaking of water	Yes = 1 No = 2	[___]
Q75	Lumbopelvic pain	Yes = 1 No = 2	[___]
Q76	Growth retardation in utero?	Yes = 1 No = 2	
Q77	Pregnancy stopped?	Yes = 1 No = 2	
Q78	Prematurity	Yes = 1 No = 2	
Q79	Full-term pregnancy?	Yes = 1 No = 2	
VII. SEROLOGICAL MARKERS			
Q80 Q81	Anti-HCV Ab by RDOT	Positive = 1 Negative = 2	[___]
Q82	If RDOT+: ELISA test result	Positive = 1 Negative = 2	[___]
Q83	HBsAg by RDOT	Positive = 1 Negative = 2	[___]
Q84	If RDOT+: ELISA test result	Positive = 1 Negative = 2	[___]
Q85	HIV serology	Positive = 1 Negative = 2	[___]

CONSENT FORM (For pregnant women)

I have read and understood the information about the purpose of the study on viral hepatitis B and C in pregnancy in the Lokossa-Athiémé reference hospitals: diagnosis and treatment.

I had the opportunity to ask any questions to the members of the research team. The answers were provided to me in language that is understandable to me.

I've understood that:

☐The disadvantages and advantages of my participation in this study

☐My participation in the study is voluntary and I can withdraw at any time.

☐The researchers involved in this study will have access to the data which concerns me in compliance with the strictest confidentiality

☐Research files could be inspected by the Parakou ethics committee to ensure the smooth running of the study.

It was clearly explained to me and I understood that my consent does not relieve the research organizers of their responsibility and I retain all my rights as guaranteed by law.

I freely and informedly consent to participate in this investigation.

Date:

Signature