Original Research Article

Sero-prevalence and risk factors for hepatitis A virus infection among pregnant women at the samandin medical center, Ouagadougou, Burkina Faso.

ABSTRACT

Aims: This study determined prevalence and possible risk factors associated with HAV infection and compared Immunochromatography (IgG) rapid point of care test with standard ELISA test for diagnosis.

Study design: Cross sectional epidemiological survey.

Place and Duration of Study: The study was carried out in Samandin Medical Center (Ouagadougou, Burkina Faso), from July 2017 to December 2017.

Methodology: A total of 180 pregnant women were recruited at the Samandin Medical Center. Anti-HAV IgM and IgG detection tests were performed using AccuDiag™ HAV ELISA kit (Calabasas, USA) and RDT SD BIOLINE HAV (Gyeonggi-do, Korea).

Results: IgG anti-HAV antibodies (AccuDiaG Elisa) were found with a prevalence of 88.9% (160/180; CI95% [84.3 – 93.5]) and Anti-HAV IgM were 1.1% (2/180; CI95% [0.0 – 2.6]). Of the 160 AccuDiag HAV IgG positive samples, 44.4% (80/180; CI95% [37.2 – 51.7]) tested positive using SD BIOLINE Diagnostics HAV IgG. Regarding risk factors, 86.9% (86/99) of the IgG positive women were illiterate; 90.7% (39/43) lived mostly in peripheries areas; 89.2% (74/83) were household worker and 88.6% (93/105) used fountains water.

Conclusion: Our results demonstrated poor agreement between the assays tested, which are consistent with previous reports demonstrating significant variability between HAV ELISA and RDT HAV. Moreover, the detection of HAV specific IgM antibodies in two asymptomatic pregnant women signed the current circulation of HAV in this area.

Keywords: Hepatitis A Virus, pregnant women, socio-economic and demographic conditions, Burkina Faso

1. INTRODUCTION

Formerly known as infectious hepatitis, hepatitis A is caused by the hepatitis A virus [1]. Hepatitis A virus (HAV) belongs to the genus *Hepatovirus* of the family of *Picornaviridae* [2, 3]. It is one of the most common infectious etiologies of acute hepatitis worldwide. Each year, more than 10 million cases identified. In addition, the epidemiology of this virus, is closely associated with unsafe water, food contaminated with the feces from infected person, poor sanitation and personal hygiene, sexual partner of acute hepatitis A infected persons, and close physical contact with an infectious person travelling to areas of high endemicity without being immunized and injecting drugs [4-6].

The endemicity of HAV in the world differs according to geographical area as shown by the prevalence studies of anti-HAV antibodies [7]. It is estimated that most children (90%) will be infected with the HAV before ten years old in developing countries with very poor sanitary conditions and hygienic practices. However, HAV infection is clinically silent in children under three years of age but is usually symptomatic in adults [8].

The clinical diagnosis of current or recent HAV infection is evoked by the presence of IgM anti-HAV antibodies [9], which can be detected immediately after infection and remain detectable for about 6 months. A healed infection can be determined by serum HAV IgG antibodies, which are detectable soon after the onset of symptoms and bring about long-term or even lifelong immunity [10].

Despite the large body of data on HAV worldwide little information is available regarding HAV infection during pregnancy. Among the few published cases, a high frequency of obstetric complications including contraction and deliveries preterm has been reported in symptomatic forms of hepatitis A during the second and third trimesters of pregnancy [11]. There are also numerous cases reported of vertical HAV transmission, utero complications and neonatal hepatitis [12-14].

In Burkina Faso, the lack of good hygiene and low socioeconomic status expose the population to enteropathogens [7, 15], from these HAV is shown to be endemic [16]. However, the few studies performed with different commercial HAV IgG enzyme immunoassays have shown large variability in seroprevalence [16]. This study aimed to examine the serodetection of HAV by two analyses methods and identify the associated factors with HAV infection among pregnant women to help inform the HAV vaccination policy.

2. MATERIALS AND METHODS

2.1 Ethical considerations

Ethical approval was obtained from Ethics Committee for Health Research by the deliberation N° 2014-12-138. The study participants received information about the study, after which they signed the written informed consent.

2.2 Study design and topics

This is a descriptive prospective study that took place from July 2017 to December 2017, in the laboratory of Samandin Urban Medical Center (Baskuy Sanitary District). We recruited 180 pregnant women from 16 to 49 years, attending prenatal clinics. After recruitment, the study protocol was explained to each woman and written informed consent was obtained. Women who agreed to participate received a pre-tested questionnaire to obtain information on demographic characteristics and risk factors, including age, gender, place of residence, education level, job, Food regime (outside), water source, medical history and diet.

2.3 Collection and processing of samples

Blood samples (5 ml) were collected in dry tubes without anticoagulant. The sample was centrifuged at 3000g for 10 min at 25°C. The sera were collected in cryotubes and stored at -20 ± 5°C until serological analysis. The sera were tested for anti-HAV IgG using the enzyme-linked immunosorbent assay (the AccuDiag DIAGNOSTIC AUTOMATION, Calabasas, USA). AccuDiag is qualitative serological assay anti-HAV IgG ELISA calculated a result based on Sample Cut-off (S/C.O.). Specimens with

S/C.O. values > 1.00 were considered negative and S/C.O. values ≤ 1.00 were considered positive for anti-HAV IgG. The cut-off was calculated by multiplying the mean absorbance value for three negative control by 0.5. The sensitivity of the test for measuring antibodies was reported as >100% and the specificity was reported as >100% according to the manufacturer's manual. All serum samples tested for IgG were tested for IgM using AccuDiag™ HAV IgM DIAGNOSTIC AUTOMATION ELISA Kit, (Calabasas, USA). The results are calculated by relating each sample's optical density (OD) value to the Cut-off value (C.O.) of the plate. Positive results must have a value of S/C.O.≥1. S is the individual absorbance (OD) of each specimen and Cut-off value (C.O.) is the mean absorbance value of the three negative controls × 2.1. Negative results must have S/C.O. <1 and samples with absorbance to Cut-off ratio between 0.9 and 1.1 are considered borderline.

Our results obtained by ELISA were subsequently compared with SD BIOLINE HAV IgG/IgM Rapid Diagnostic Test. SD BIOLINE HAV IgG/IgM Rapid Test is a solid phase immunochromatographic assay for the rapid, qualitative detection. The sensitivity of this last test is 97.6% and the specificity is 98.0% according to the manufacturer's manual. In brief HAV IgG/IgM rapid test is a solid phase immunochromatographic assay for the differential, rapid and qualitative detection of HAV IgG and IgM antibodies in human serum or plasma.

2.4 Statistical analyzes

Logistic regression analyses were carried out to determine which variables were significantly associated with detection of HAV antibodies. The lower and upper limits of the 95% confidence interval (CI) for a proportion were also calculated.

3. RESULTS

3.1 Socio-demographic characteristics of study participants

The average age of the study population is 26.3 ± 0.9. Regarding the level of education, 45% of participants have completed primary, secondary or higher education; 55% were illiterate. Of the hundred and eighty (180) pregnant women, 53.9% were official workers and 46.1% were household worker (Table 1). Concerning the source of drinking water, 41.7% of the pregnant women used taps water, supplied by the national office of water and sanitation (ONEA) and 58.3% used fountains water. 76.1% of study population resided in the urban area and only 23.9% lived in the peripheries of Ouagadougou (Table 1).

According to their activities, the pregnant women had a diversified diet out of home consisting of fruit, vegetables, meat and others (rice and maize cake). Fruits and vegetables are eaten according to the season.

Table 1. Socio-demographic characteristics of study participants (N = 180)

CHARACTERISTICS	NUMBER	PERCENTAGE (%)
AGE		
[16-25[	**81**	**45.0%**
[25-36[	**86**	**47.8%**
≥ 36	**13**	**7.2%**
LEVEL OF EDUCATION		
SCHOOLED	**81**	**45%**
OUT OF SCHOOL	**99**	**55%**

PROFESSION		
OFFICIAL WORKERS	**97**	**53.9%**
HOUSEHOLD WORKER	**83**	**46.1%**
LOCALITY		
PERIPHERY	**43**	**23.9%**
CENTER	**137**	**76.1%**
SOURCE OF WATER SUPPLY		
TAP	**75**	**41.7%**
FOUNTAIN	**105**	**58.3%**
FOOD FOODREGIME (OUTSIDE)		
FRUITS AND VEGETABLES	**58**	**32.2%**
PORK MEATS (GRILL)	**61**	**33.9%**
OTHERS	**61**	**33.9%**
GYNECOLOGICAL ANTECEDENTS		
ABORTION	**2**	**1.1%**
BORN DEAD	**0**	**0.0 %**

3.2 Seroprevalence and comparison of HAV antibody test results in pregnant women.

Using the rapid detection test (RTD, SD Bioline) the IgG HAV seropositivity was 44.4% (80/180; CI95% [37.2 – 51.7]) while using the ELISA test (AccuDiag), it was 88.9% (160/180; CI95% [84.3 – 93.5]) (Table 2). Of the 160 AccuDiag HAV IgG reactive samples, 80 were reactive with the SD BIOLINE IgG Anti-HAV IgG immunochromatographic assay. There was a poor agreement between these assays (Table 2). All AccuDiag HAV IgG negative samples were also negative with SD BIOLINE IgG Anti-HAV IgG assay (Table 2). According of these results, AccuDiag HAV ELISA appears to be the reference test for the diagnostic of HAV. Thus, the diagnostic efficacy of SD Bioline test when compared with ELISA showed a positive predictive value (PPV) and negative predictive value (NPV), which were respectively 44.4% and 100%.

Table 2: Comparison of IgG HAV antibody test results using RDT SD BIOLINE and Diagnostics AccuDiag HAV ELISA kits

		SD BIOLINE IgG Anti-HAV		
		Positive	Negative	Total
AccuDiag HAV IgG	Positive	80 (44.4%)	80 (44.4%)	160 (88.9%)
	Negative	0 (0.0%)	20 (11.1%)	20 (11.1%)

Total	80 (44.4%)	100 (55.5%)	180

In our 180 pregnant women population, 5 women were IgM HAV positive (2.8%; CI95% [0.4 – 5.2]) using RDT (SD Bioline) while using the ELISA test (AccuDiag), only 2 were IgM anti-HAV + (1.1%; CI95% [0.0 – 2.8]). The two AccuDiag HAV IgM positive samples were positive with SD BIOLINE IgM Anti-HAV antibody assay. Of the 5 SD BIOLINE Anti-HAV IgM positive samples, 03 were tested negative for HAV IgM on SD BIOLINE IgM Anti-HAV (Table 3). Positive predictive value (PPV) and Negative predictive value (NPV) were respectively 100% and 98.3%, according to the diagnostic efficacy of SD Bioline test when compared with ELISA.

Table 3: Comparison of test results between the AccuDiag HAV IgM ELISA and RDT HAV IgM SD BIOLINE Diagnostics

		SD BIOLINE IgM Anti-HAV		
		Positive	Negative	Total
AccuDiag HAV IgM	Positive	02 (1.1%)	00 (0.0%)	02 (1.1%)
	Negative	03 (1.7%)	175 (97.2%)	178 (98.9%)
	Total	05 (2.8%)	175 (97.2%)	180

3.3 Population stratification and risk factor analysis

Relative to pregnant women over 36 years (84.6% (11/13)), HAV positive was high among women of below 25 years age (90.1% (73/81)), followed by 25-36 years group (88.4% (76/86)) (Table 4). 90.7% (39/43) of the positive pregnant women resided in the peripheries area and 88.3% (121/137) lived in the urban settlemen. Regarding the level of education, 91.4% (74/81) of schooled and 86.9% (86/99) of out of school were positive IgG anti-HAV. In addition, 89.2% (74/83) of positive pregnant women were household worker and 88.6 (93/105) used fountains water. Not any risk factors were statistical evidence of infection association (Table 4).

The prevalence of HIV among pregnant women was 2.5% (4/180; CI95% [0.1 – 4.9]). All the HIV positive women were co-infected with HAV (p <0.05).

Table 4: Prevalence of HAV antibodies according to population stratification and risk factors

Population stratification	***IgG anti HAV Prevalence using ELISA***	***OR (95% CI)***	***p-Value***
Age			
[16-25[	90.1% (73/81)	1.7 [0.2 – 7.8]	0.8234

[25-36[	88.4% (76/86)	1.4 [0.2 – 6.2]	
+ de 36	84.6% (11/13)	-	
Level of education			
Schooled	91.4% (74/81)	1.6 [0.6 – 4.4]	0.3404
Out of school	86.9% (86/99)	-	
Profession			
Household worker	89.2% (74/83)	1.1 [0.4 – 2.7]	0.9158
Official workers	88.7% (86/97)	-	
Food regime (outside)			
Fruits and vegetable	84.4% (49/58)	-	
Pork meat	95.1% (58/61)	3.5 [1 – 16.7]	0.1436
Nothing	86.9% (53/61)	1.2 [0.4 – 3.5]	
Locality			
Center	88.3% (121/137)	-	0.6653
Periphery	90.7% (39/43)	1.3 [04 – 4.7]	
Source of water supply			
Tap	89.3% (67/75)	1.1 [0.4 – 2.9]	0.8726
Fountain	88.6% (93/105)	-	

4. DISCUSSION

This study aimed to determine the prevalence of HAV infection through two different detection methods, while exploring the risk factors associated with this infection in Samandin Urban Medical Center (Ouagadougou).

4.1 Seroprevalence of HAV antibody in pregnant women.

In this study, a poor concordance of test results between the two tested commercial HAV IgG/IgM (AccuDiag ELISA and SD BIOLINE immunochromatographic assay) was observed. Only 44.4% (80/180) of AccuDiag HAV IgG positive samples were positive with the SD BIOLINE Diagnostics HAV IgG. The AccuDiag ELISA test was more sensitive than the RDT SD BIOLINE ($p < 0.001$). This observation is similar to a study conducted by Traore et al, which reported the low prevalence of IgG anti-HAV with SD Bioline kit [16]. HAV IgM assays also showed poor agreement between two assays. Thus, in our study, Three HAV IgM positive sample with the SD Bioline HAV IgM assay was negative with AccuDiag HAV IgM assay. All two samples positive with AccuDiag HAV IgM assay were also positive with SD Bioline HAV IgM assay, demonstrating agreement between these assays. Although rapid diagnostic tests are more practical, ELISA tests where large numbers of samples are tested, seem to provide results that are more reliable, and should be of most use in routine diagnostic laboratories. However, the rapid test have greatest utility in peripheral health settings where relatively few specimens are processed [17]. The present study showed an incidence of 1.1% of HAV infection with ELISA in pregnant women. The results of this study supported by the study of Traore et al. (2%), which indicated that the incidence

of infections is relatively high and that there is a risk of major outbreaks if vaccination is not continued [7, 18].

4.2 Coinfection between HAV antibodies and HIV

In this study, 2.5% of HAV positive pregnant women were co-infected with HIV. All of positive cases had IgG-anti HAV antibodies and were found among household worker. A prior study has shown Early HIV infection may predispose to HAV infection and this coexistence carries a high risk of morbidity and mortality for pregnant women [19]. The positive association old markers of exposure to HAV and HIV infection may suggest epidemiological and/or pathogenic links, which need to be further clarified in well-designed studies in the future.

4.3 Prevalence of HAV antibodies and risk factors

When analyzed according to age groups, the prevalence of IgG anti-HAV (ELISA) ranged from 84.6 - 90.1% among pregnant women between 16 to 45 years old (figure 1), which is similar to high prevalences of HAV observed in west African countries [16, 20]. These high prevalences could be related to the source of water supply and sanitation, and individual social characteristics who did not change behaviors toward the prevention and awareness of the disease. In addition, the young adults there appeared to be the most exposed to the external environment thereby exposing them to the virus. In this study, the prevalence of HAV infection among women living in unsanitary and unserviced areas (Periphery , 90,7%) was higher than the one of women living in serviced areas (Center, 88,3%) (table II). Of the 180 pregnant women, 58.3% used fountain water for drinking, washing vegetables and fruit, washing kitchen utensils, which was emphasized as a risk factor for HAV in other studies [20, 21]. However, in our study, no socioeconomic variables such as educational level, nor environmental variables such as access to safe water environmental were significantly associated with HAV, although the local environmental conditions theoretically favour the transmission of enteric pathogens. Moreover, the overall level of knowledge about hepatitis A was generally poor among the pregnant women.

In our study we found no statistically significant result when the medical history explored. Nevertheless, Israeli researchers claim that the occurrence of acute hepatitis A in a pregnant woman is associated with high rates of gestational complications and premature delivery [22]. A few cases of mother-to-child transmission of virus A have also been published, responsible for neonatal hepatitis or in utero complications [12], which we have not explored and which could be a subject of future research.

5. CONCLUSION

This study revealed a poor concordance of test results between the AccuDiag ELISA and SD BIOLINE immunochromatographic. Moreover, the detection of HAV specific IgM antibodies in the asymptomatic pregnant woman, is high suggestive of the possibility of a vertical HAV transmission. Future studies should try to understand the difference in the analytical sensitivity of these two anti-HAV assays.

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