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Prevalence of HBV and HCV Markers among Patients Attending the Saint Camille Medical Centre in Ouagadougou

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Abstract: HCV and HBV cause annually, 2000 deaths from liver cancer in Burkina Faso. In this country, serological screening of hepatitis viruses B and C is only systematic among blood donors. The aims of this study were; (1) to investigate the reasons for the prescription of the screening for hepatitis B and C; (2) to determine HCV and HBV prevalence among 462 patients attending the Saint Camille Centre and (3) to identify patients with acute hepatitis or with chronic hepatitis for better monitoring. From February to May 2012, 462 patients attending the laboratory of the Saint Camille Medical Centre with viral hepatitis suspicion were screened. The hepatitis B and C serological markers were detected through Enzyme Immuno Assay (EIA) technique using commercial reagent kits. The clinical symptoms were also recorded for each patient. The results revealed that, the main clinical symptoms that prompted physicians to request HBV and HCV screenings were: asthenia (39.4%), anorexia (21.2%), abdominal pains (19.0%), nausea (10.4%), others (10.0%). The prevalence of HbsAg was 29.4% among the screened people. Patients with acute hepatitis B, active chronic hepatitis B and non-active chronic hepatitis B represented 11.2, 2.2 and 16.0%, respectively. The acquisition of immunity against HBV after vaccination was attempted for 11.7% people. HCV prevalence was 3.9% and its coinfection with HBV was 2.2%. This study showed a high prevalence for hepatitis B and C among patients attending Saint Camille Medical Centre. Without hygiene education and HBV/HCV prevention, viral hepatitis infection will become a serious public health problem in Burkina Faso.

Key words: Viral hepatitis, public health, infection, Burkina Faso

INTRODUCTION

In developing countries, mainly in West Africa, viral hepatitis is a serious health problem (Hoffmann and Thio, 2007; Bosan *et al*., 2010). In this region, the prevalence of Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) are very high compared with Western Europe, Australia and North America (CDC, 2008) and most of those infected people are chronic carriers. But this prevalence varies from one country to another in Africa (Ouermi *et al*., 2009). Also, coinfection with both viruses is very common because of certain risk practices such as female genital mutilation, circumcision, ethnic scarifications, forced marriage, levirate etc. (Simpore *et al*., 2011; Kazmi *et al*., 2003). Most of people infected with HBV spontaneously eliminate the virus after six months but some ones become chronic carriers and can develop chronic hepatitis.

In many African countries, viral hepatitis screening is not systematic and many peoples are infected by HBV and HCV without knowing it. This ignorance contributes to the spread of these viruses by parenteral route, sexual and mother-child transmission (Ilboudo *et al*., 2010). These two viruses lead to any physical disturbs as abdominal pains, nausea, anorexia, asthenia and, in some cases, to hepatocellular carcinoma (Kao and Chen, 2002; Liu and Fan, 2007; Chakraborty *et al*., 2012). The coinfection with HBV and HCV is, in sub-Saharan Africa, the second cause of cancer in males and the third cause of cancer in females (Parkin *et al*., 2008).

In Burkina Faso, HBV prevalence is higher than 8% when HCV infects about 2% of the population (Simpore *et al*., 2006) and both viruses cause annually 2000 deaths from liver cancer in the country (Pietra *et al*., 2008). The objectives of this study were (1) To investigate

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the clinical signs that allowed physicians to prescribe screening for hepatitis B and C, (2) To determine HCV and HBV prevalence among 462 patients attending the Saint Camille Medical Centre (SCMC) and (3) To identify patients with acute hepatitis or with chronic hepatitis for better monitoring.

MATERIALS AND METHODS

Patients' recruitment: This study concerned 462 patients of 2-72 years old (mean 33.2±11.3), who came to the laboratory of the SCMC for hepatitis B or/and hepatitis C screening from February-May 2012. All the patients, freely, agreed to answer our questionnaire referring to their clinical symptoms: asthenia, anorexia, abdominal pains, nausea. In the SCMC, HBV and HCV screening are usually done with rapid ELISA test on blood samples, previously collected in EDTA impregnated tubes.

Serological test: The collected blood samples were centrifuged to separate the serum which was used for screenings. HBV serological markers (HbsAg, HbsAb, HbeAg, HbeAb and HbcAb) and anti-HCV were detected through Enzyme Immuno Assay (EIA) technique using commercial diagnostic kits (ACON Laboratories, Inc., USA) as described by Buseri *et al.* (2010).

Statistical analysis: The prevalence of each serological marker was established according to sex and age group. The collected data were analyzed by standard software SPSS-10 and EpiInfo-6. Statistical significance was set at $p<0.05$.

Ethical aspect: The ethics committee of the Center of Molecular Biology Research (CERBA) and of Saint Camille Medical Centre (CMSC) gave its approval for this study.

RESULTS

The present study concerned 462 patients including 242 (52.4%) males and 220 (47.6%) females (sex ratio: 1.58). The ages ranged from 2-72 years (mean 33.2±11.3). Regarding the clinical symptoms or the reasons for the screening, 39.4% (182/162) suffered from asthenia, 21.2% (98/462) from anorexia, 19.0% (88/462) from abdominal pains and 10.4% (48/462) from nausea (Table 1). Other reasons involving prenatal screening, vaccination, concerned 46 patients (10.0%).

Table 2 showed that 136 individuals (29.4%) were positive for HbsAg. According to sex, HbsAg prevalence was higher in females (30.0%) than in males (28.9%) but the difference was not statistically significant ($p>0.05$). Among the screened individuals 11.2% (52/462) had acute hepatitis B and 2.2% (10/462) had chronic active hepatitis B (Table 3). Seventy-four patients (16.0%) were healthy carriers of hepatitis B virus. Vaccinal immunity was observed in 54 persons (11.7%) while 68 (14.7%) had never been infected with HBV.

Table 1: Symptoms that prompted the request for viral hepatitis screening

	Asthenia		Anorexia		Abdominal Pains		Nausea		Others		Total	
Individuals	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	86	35.5	70	28.60	34	14.3	34	14.3	18	7.3	242	100
Female	69	43.7	28	12.5	54	25.0	14	6.2	28	12.5	220	100
Total	182	39.4	98	21.2	88	19.0	48	10.4	46	10.0	462	100

Table 2: HBV and HCV markers prevalence according to age

	Patients		HBV HbsAg		HbsAb		HbeAg		HbeAb		HbcAb		HCV HcvAb	
Age (years)	N	%	N	%	N	%	N	%	N	%	N	%	N	%
<19	28	6.1	8	28.6	14	50.0	4	14.3	18	64.3	22	78.6	0	0
20-29	158	34.2	40	25.3	80	50.6	14	8.9	48	30.4	114	72.2	8	5.1
>30	276	59.7	88	31.9	126	45.6	44	15.9	74	26.8	196	71.10	10	3.6
Total	462	100.0	136	29.4	220	47.6	62	13.4	140	30.3	332	71.9	18	3.9

HBV: Hepatitis B virus, HBC: Hepatitis C virus, HbsAg: Hbs antigen, HbsAb: Anti Hbs antibody, HbeAg: Hbe antigen, HbeAb: Anti Hbe antibody, HbcAb: Anti Hbc antibody, HcvAb: Anti Hcv antibody

Table 3: Prevalence of HBV markers according to the natural history of HBV

	Acute hepatitis[a]		Chronic active hepatitis[b]		Non active chronic hepatitis[c]		Ancient recovery[d]		Vaccinal immunity[e]		No exposition to the virus[f]		Total	
Individuals	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Male	28	11.6	4	1.7	38	15.7	113	46.7	24	9.9	35	14.4	242	100
Female	24	10.9	6	2.7	36	16.4	91	41.4	30	13.6	33	15.0	220	100
Total	52	11.2	10	2.2	74	16.0	204	44.2	54	11.7	68	14.7	462	100

[a]All markers positive, [b]Positive for HbsAg, HbeAg and HbcAb after six months, [c]Positive for HbsAg, HbeAb and HbcAb after six months, [d]Positive for HbsAb, HbeAb, HbcAb or HbsAb and HbcAb, [e]Positive for Only HbsAb, [f]Negative for all markers

Table 4: Comparison of HBV and HCV prevalence according to gender

	Total (n = 462)		Male (n = 242)		Female (n = 220)		
Infection	Ratio	%	Ratio	%	Ratio	%	p-value*
HBV	136	29.4	70	28.9	66	30.0	0.800
HCV	18	3.9	10	4.1	8	3.6	0.783
HBV/HCV	10	2.2	4	1.7	6	2.7	0.637

*p-value comparing male/female gender

The prevalence of HCV was 3.9% (18/462). No infection with HCV was observed in the age group<19 years but the highest prevalence was observed among individuals aged from 20 to 29 years (Table 2). No significant difference was observed according to gender for HCV infection (p = 0.783). Ten persons (2.2%) were coinfected with HBV and HCV (Table 4).

DISCUSSION

Burkina Faso, located in Sub-Saharan Africa, is considered as a high endemicity area of HBV infection (more than 8% of the population is HBV carriers) and a low HCV prevalence region (less than 2%) (WHO, 2004; Pietra *et al*., 2008).

This study is different from those previously conducted in the SCMC (Ilboudo *et al*., 2003, 2010; Simpore *et al*., 2004, 2006). Indeed, these previous studies involved only pregnant women or mothers/children or people infected by HIV. In our investigations, the sample consisted of people with symptoms suspecting hepatitis such as asthenia, anorexia, abdominal pains and nausea and so on.

In this study, it has been found that the main reason for HBV and HCV screening was "suspicion of viral hepatitis". Indeed, the prescriptions orders were asthenia (39.4%), anorexia (21.2%), abdominal pains (19.0%) and nausea (10.4%). The others reasons including pregnancy, post vaccination test and voluntary testing, represented 10.0%. But this trend was not observed in other studies. Agbenu *et al*. (2008) reported in their study that, the indication "screening for HBV" represented more than 40% of the medical indications declared by the prescribing physicians while the indication "suspected hepatitis" accounted for less than 20%.

In 2006, the vaccination against hepatitis B began in our country for newborns but the prevalence of anti-Hbs is low in the general population. Our findings showed that only 11.7% of screened people had immunity against HBV after vaccination. This rate is very low compared to those found in Italy (more than 90%) (Paola *et al*., 2009) and in Germany (more than 80%) (Schenkel *et al*., 2008). Detection of HBV markers plays an important role in the biological monitoring of HBV infection (Galula *et al*., 2006) and the presence of HbsAg in blood is considered a risk factor for hepatocellular carcinoma by some epidemiological studies. The prevalence of HbsAg found was 29.4%. However, this prevalence is not representative of the general population of Burkina Faso and this is very high compared to those previously reported by Pietra *et al*. (2008), Ilboudo *et al*. (2007) and Simpore *et al*. (2004) which were respectively 12.1% among health personnel, 16.7% among HIV positive patients and 9.1% among pregnant women. This difference could be related to the study populations. In this study, the HBV prevalence among women was 30.0%. This rate (30.0%) is higher than those found among women, respectively by Ilboudo *et al*. (2003) in Ouagadougou (12.04%), Simpore *et al*. (2006) in Ouagadougou (11.6%), Otegbayo *et al*. (2008) in Nigeria (11.9%), Nagu *et al*. (2008) in Tanzania (17.3%) as well as Balan *et al*. (1998) in Romania (36.7%). However, our results are lower than those of Lukhwareni *et al*. (2009) in South Africa (40.6%). These differences in prevalence show that hepatitis B infection constitutes a serious public health problem in Sub-Saharan Africa and over the world.

It has also been noticed that more than 18.0% of peoples screened for HBV were chronically infected with this virus. Among these chronic carriers, 2.2% who have HbsAg positive and HbeAg positive, have active hepatitis B. According to some studies, AgHbe which indicates the high viral replication is a bad prognosis for the evolution of liver disease in HBV chronic carriers (Hwai *et al*., 2002). In Burkina Faso, without considering HCV, more than 1000 peoples die every year for liver cancer due to HBV infection (Pietra *et al*., 2008). The majority of HBV chronic carriers were infected during childhood and some authors reported that HBV infection in children is transmitted during the perinatal period (Zanetti *et al*., 2008). About 90% of children infected by the perinatal route become chronic carriers of the virus, because of their immature immune system (Michielsen *et al*., 2005). The rate of HBV perinatal transmission is over 20% (Onakewhor *et al*., 2001; El-Magrahe *et al*., 2010). This rate would increase if the mother is HbeAg-positive (Hou *et al*., 2001; Wiseman *et al*., 2009; Ilboudo *et al*., 2010). So, in Burkina Faso, about 11% of pregnant women are HBV chronic carriers (Simpore *et al*., 2006; Ilboudo *et al*., 2010) and the rate of HBV antennal transmission is 37.1% (Sangare *et al*., 2009).

In this report, females (30.0%) were more infected by HBV than males (28.9%) but the difference was not significant (p>0.05). Some authors have previously reported that men were more infected with HBV than women. Indeed, Tsay *et al*. (2009) showed in their study that HBV prevalence was 21.7% in males versus 17.2% in females. The same authors also suggested that, the fact that most of HBV infections occur during childhood and

the fact that there is a high immunity in females than males, contribute to HbsAg clearance in females. However, the prevalence reported in this study was in contrast with the reports of Tsay *et al.* (2009) . So, our findings suggest that, like HIV, HBV epidemiology has a feminine face in Sub-Saharan Africa. Indeed, because of factors such as physiological predispositions (more surface contact during sexual intercourses, hemorrhage during traumatic sex), genital excision and social power, women are more vulnerable than men to HBV infection.

There are few epidemiological studies regarding to the prevalence of HCV in Burkina Faso. In general, this prevalence is globally low and varies according to the time of study and the kind of study population. For example HCV prevalence was 3.3% among pregnant women in 2002 (Ilboudo *et al.*, 2010) and was 2.1% in the same center in 2009 (Zeba *et al.*, 2011). Among blood donors, this prevalence reached 7% (Nagalo *et al.*, 2011). In this study, 3.9% of screened people had antibodies against HCV. In Burkina Faso, HBV and HCV infections are frequently due to some practices such as women excision, ethnic scarifications and domestic use of objects contaminated with infected blood, so coinfection with HCV and HBV is common. The coinfection (HBV-HCV) rate in the present study was 2.2% and was lower than that reported by Simpore *et al.* (2006) (3.9%) among HIV positive women. This difference supports the idea that HBV and HCV are more prevalent in people infected by HIV (Muhammad *et al.*, 2011). Now it is well known that coinfection of HBV with HCV can induce liver inflammation (Liu and Hou, 2006) with onset of fibrosis progressing to cirrhosis and its complications: liver cancer, gastrointestinal bleeding and in the end, severe hepatic dysfunction requiring transplantation.

CONCLUSION

Hepatitis B and C are serious health problems with severe consequences and this study showed a high prevalence of HBV and HCV markers. This high prevalence reflects the absence of health policy for fighting against these diseases. So, some measures must be taken to control their spreading. On one hand, for hepatitis B vaccination is essential for the uninfected peoples and on the other hand, the prevention is the best way to protect populations against hepatitis in the world.

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REFERENCES

Agbenu, E., A. Banla, M. Kolou, A. D'Almeida, A. Kpotsra, A. Dorkenoo and D. Redah, 2008. Serologic markers used for hepatitis B surveillance in Togo: Status report and action proposals. Med. Trop., 68: 621-624.

Balan, A., N. Beldescu and R. Popa, 1998. The prevalence of viral hepatitis B in pregnant women in an area of southern Romania. Bacteriol. Virusol. Parazitol. Epidemiol., 43: 254-260.

Bosan, A., H. Qureshi, K.M. Bile, I. Ahmad and R. Hafiz, 2010. A review of hepatitis viral infections in Pakistan. J. Pak. Med. Assoc., 60: 1045-1058.

Buseri, F., E. Seiyaboh and Z. Jeremiah, 2010. Surveying infections among pregnant women in the Niger Delta, Nigeria. J. Global Infectious Dis., 2: 203-211.

CDC, 2008. Recommendations for identification and public health management of persons with chronic hepatitis B virus infection. Morbidity Mortality Weekly Rep., 57: 1-20.

Chakraborty, J.B., F. Oakley and M.J. Walsh, 2012. Mechanisms and biomarkers of apoptosis in liver disease and fibrosis. Int. J. Hepatol. (In Press).

El-Magrahe, H., A.R. Furarah, K. El-Figih, S. El-Urshfany and K.S. Ghenghesh, 2010. Maternal and neonatal seroprevalence of hepatitis B surface antigen (HBsAg) in Tripoli Libiya. J. Infect. Dis. Dev. Ctries., 4: 168-170.

Galula, G., C. Buffet, L. Robba and M. Poissonnet, 2006. Assessment of prescription practices for serological tests for viral hepatitis B and C in the Greater Parisian area in 2002. Gastroenterol. Clin. Biol., 30: 517-524.

Hoffmann, C.J. and C.L. Thio, 2007. Clinical implications of HIV and hepatitis B co-infection in Asia and Africa. Lancet Infect Dis., 7: 402-409.

Hou, J., Z. Wang, J. Cheng, Y. Lin and G.K. Lau *et al.*, 2001. Prevalence of naturally occurring surface gene variants of hepatitis B virus in nonimmunized surface antigen-negative Chinese carriers. Hepatology, 34: 1027-1034.

Hwai, I.Y., S. Lu, Y.F. Liaw, S.L. You and C.A. Sun *et al.*, 2002. Hepatitis B e antigen and the risk of hepatocellular carcinoma. N. Engl. J. Med., 347: 168-174.

Ilboudo, D., A. Sawadogo and J. Simpore, 2003. Hepatitis C and HIV co-infection in pregnant women, Ouagadougou (Burkina Faso). Med. Maladies Infectieuses, 33: 276-279.

Ilboudo, D., D. Karou, W.M.C. Nadembega, A. Savadogo and O.D.S. Pignatelli *et al*., 2007. Prevalence of human herpes virus-8 and hepatitis B virus among HIV seropositive pregnant women enrolled in the mother-to-child HIV transmission prevention program at saint Camille medical centre in Burkina Faso. Pak. J. Biol. Sci., 10: 2831-2837.

Ilboudo, D., J. Simpore, D. Ouermi, C. Bisseye and T. Sagna *et al*., 2010. Towards the complete eradication of mother-to-child HIV/HBV coinfection at Saint Camille Medical Centre in Burkina Faso, Africa. Braz. J. Infect. Dis., 14: 219-224.

Kao, J.H. and D.S. Chen, 2002. Global control of hepatitis B virus infection. Lancet, 2: 395-403.

Kazmi, K., A. Ghafoor and A.W. Qureshi, 2003. Mother-infant transmission of hepatitis B in Pakistan. Pak. J. Med. Res., 42: 152-156.

Liu, Z. and J. Hou, 2006. Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) Dual Infection. Int. J. Med. Sci., 3: 57-62.

Liu, J. and D. Fan, 2007. Hepatitis B in China. Lancet, 369: 1582-1583.

Lukhwareni, A., R.J. Burnett, S.G. Selabe, M.O. Mzileni and M.J. Mphahlele, 2009. Increased detection of HBV DNA in HBsAg-positive and HBsAg-negative South African HIV/AIDS patients enrolling for highly active antiretroviral therapy at a Tertiary Hospital. J. Med. Virol., 81: 406-412.

Michielsen, P.P., S.M. Francque and J.L. van Dongen, 2005. Viral hepatitis and hepatocellular carcinoma. World J. Surg. Oncol., 3: 1-18.

Muhammad, N., A. Qasim, G. Jafferi, M. Anwar and M. Muazzam, 2011. HIV infection, HIV/HCV and HIV/HBV co-infections among jail inmates of Lahore. Pak. J. Med. Sci., 27: 837-841.

Nagalo, M.B., M. Sanou, C. Bisseye, M.I. Kabore and Y.K. Nebie *et al*., 2011. Seroprevalence of human immunodeficiency virus, hepatitis B and C viruses and syphilis among blood donors in Koudougou (Burkina Faso) in 2009. Blood Transfus, 9: 419-424.

Nagu, T.J., M. Bakari and M. Matee, 2008. Hepatitis A, B and C viral co-infections among HIV-infected adults presenting for care and treatment at Muhimbili National Hospital in Dar es Salaam, Tanzania. BMC Public Health, Vol. 8. 10.1186/1471-2458-8-416

Onakewhor, J.U.E., E. Offor and F.E. Okonofua, 2001. Maternal and neonatal seroprevalence of Hepatitis B surface antigen (HBsAg) in Benin City, Nigeria. J. Obstetrics Gynaecol., 21: 583-586.

Otegbayo, J.A., B.O. Taiwo, T.S. Akingbola, G.N. Odaibo and K.S. Adedapo *et al*., 2008. Prevalence of hepatitis B and C seroposotivity in a Nigerian cohort of HIV-infected patients. Ann. Hepatol., 7: 152-156.

Ouermi, D., J. Simpore, A.M.G. Belem, D.S. Sanou and D.S. Karou *et al*., 2009. Co-infection of *Toxoplasma gondii* with HBV in HIV-infected and uninfected pregnant women in Burkina Faso. Pak. J. Biol. Sci., 12: 1188-1193.

Paola, S., E. Girardi, M. Fusco, P. Piselli and S. Russo *et al*., 2009. Lack of implementation of Hepatitis B Virus (HBV) vaccination policy in household contacts of HBV carriers in Italy. BMC Infect. Dis., Vol. 9. 10.1186/1471-2334-9-86

Parkin, D.M., F. Sitas, M. Chirenje, L. Stein, R. Abratt and H. Wabinga, 2008. Part I: Cancer in Indigenous Africans-burden, distribution and trends. Lancet Oncol., 9: 683-692.

Pietra, V., D. Kiema, D. Sorgho, S.P.C.G. Kabore and S. Mande *et al*., 2008. Prevalence of hepatitis B virus markers and hepatitis C virus antibodies in health personnel in the District of Nanoro, Burkina Faso. Sci. Technol., 31: 53-59.

Sangare, L., R. Sombie, A.W. Combassere, A. Kouanda, D. Kania, O. Zerbo and J. Lankoande, 2009. Antenatal transmission of hepatitis B virus in an area of HIV moderate prevalence, Burkina Faso. Bull. Soc. Pathol. Exot., 102: 226-229.

Schenkel, K., D. Radun, V. Bremer, N. Bocter and O. Hamouda, 2008. Viral hepatitis in Germany: Poor vaccination coverage and little knowledge about transmission in target groups. BMC Public Health, Vol., 8. 10.1186/1471-2458-8-132

Simpore, J., D. Ilboudo, A. Samandoulgou, P. Guardo, P. Castronovo and S. Musumeci, 2004. HCV and HIV coinfection in pregnant women attending St. Camille medical centre in Ouagadougou (Burkina Faso). J. Med. Virol., 75: 209-212.

Simpore, J., A. Savadogo, D. Ilboudo, M.C. Nadembega and M. Esposito *et al*., 2006. *Toxoplasma gondii*, HCV and HBV seroprevalence and co-infection among HIV-positive and-negative pregnant women in Burkina Faso. J. Med. Virol., 78: 730-733.

Simpore, J., E. Compaore, J. Sawadogo, F. Djigma and D. Ouermi *et al*., 2011. Human immunodeficiency virus prevention among HIV-serodiscordant couples in Burkina Faso: Biomedical issues, bioethical and cultural challenges. World J. AIDS, 1: 185-191.

Tsay, P.K., D.I. Tai, Y.M. Chen, C.P. Yu, S.Y. Wan, Y.J. Shen and D.Y. Lin, 2009. Impact of gender, viral transmission and aging in the prevalence of hepatitis B surface antigen. Chang Gung Med. J., 32: 155-164.

WHO, 2004. Estimated total deaths by cause and WHO member state, 2002. Department of Measurement and Health Information, WHO, Geneva, Switzerland.

Wiseman, E., M.A. Fraser, S. Holden, A. Glass and B.L. Kidson *et al*., 2009. Perinatal transmission of hepatitis B virus: An Australian experience. Med. J. Aust., 190: 489-492.

Zanetti, A.R., P. van Damme and D. Shouval, 2008. The global impact of vaccination against hepatitis B: A historical overview. Vaccine, 26: 6266-6273.

Zeba, M.T.A., S.D. Karou, T. Sagna, F. Djigma and C. Bisseye *et al*., 2011. HCV prevalence and co-infection with HIV among pregnant women in Saint Camille Medical Centre, Ouagadougou. Trop. Med. Int. Health, 16: 1392-1396.