African Multidisciplinary
Journal of Sciences and Artificial Intelligence

ISSN : 3434-9871

Index: Harvard, Boston, Sydney University, Dimensions, Lens, ResearchGet Scilit, Semantic, Google Scholar, Base etc

https://doi.org/10.58578/AMJSAI.v1i1.3294

Prevalence of Malaria Parasitemia (MP) and Hepatitis B Surface Antigen (HBsAg) Co-Infection Among HIV/AIDS Patients, Jalingo, Taraba State

Akwa Vera Y.[1], Okonofua Eghe Patricia[2], Ifraimu Daniel[3], Bando Christopher David[4*], David Ephraim Haruna[5], Adamu Tutuwa Nashuka[6]

[1]Taraba State University, Jalingo, Nigeria

[2,3,4,6]National Biotechnology Research and Development Agency, Jalingo, Nigeria

[5]Plateau State University, Bokkos, Nigeria

bandomidase@gmail.com

Article Info:

Submitted:	Revised:	Accepted:	Published:
Jun 1, 2024	Jun 16, 2024	Jun 28, 2024	Jul 3, 2024

Abstract

Human Immunodeficiency Virus (HIV) cannot be called a particular diseases or infection, but it could rightly be referred to as a phenomenon or syndrome that breaks through the body defense mechanism gradually which exposes the body to all kind of diseases resulting in Acquired Immune Deficiency Syndrome (AIDS). This Study focused on the prevalence of malaria and Hepatitis B surface Antigen (HBsAg) in people living with HIV. The result of the study has revealed that out of 148 HIV patients attending clinic at government house clinic Jalingo, 114 (77%) tested positive for malaria and 13 tested positive to hepatitis B surface antigen (HBsAg) with a prevalence of 8.8%. An association between HIV and occupation was evaluated, high risk occupation, based on the exposure to associated risk factor (student, civil servants and business men) accounted for high prevalence of 75.6%, while low risk occupation (housewives and farmers) accounted for 24.5%. 91(61.4%) of the patients reside in the rural areas while 57(38.5%) reside in the urban area. It was observed that male of both rural and urban area within the age group of

AMJSAI Journal is licensed under a Creative Commons Attribution-NonCommercial-ShareAlike 4.0 International License

26-30 and 41-45 years presented a higher prevalence of 39% and 18.2% respectively while patients of both rural and urban area within the age group of 0-5 and 11-15 years accounted for a lower incidence rate with only 2.4% and 4% respectively.

Keywords: HBsAg, Malaria parasitemia, HIV/AIDS, HBV

INTRODUCTION

Never in history has there arisen such a wide spread and fundamental threat to human development as AIDS. Nigeria is one of the countries that are experiencing the most severe HIV/AIDS. HIV belongs to a group of viruses called retrovirus that include leukemia viruses in humans (Chung *et al.*, 2001; Thio and Locamini, 2007). There are several clinical steps in the life cycle of HIV. The first step is the binding of the virus envelope to the CD4 receptors found on the helper T- lymphocytes. The virus then fuses with the host cell releasing viral RNA into the cytoplasm. The viral enzyme reverse transcriptase then responsible for forming a single stranded DNA the viral RNA template. The single stranded DNA is then duplicated to form a double stranded structure called viral DNA which entered the cell nucleus and integrate itself in to the host genome.

Hepatitis cause by HBV is the main cause of transfusion associated chronic disease, liver cirrhosis, hepatocellular carcinoma and death. Patients with chronic renal failure acquired HBV via blood or sexual intercourse (Thomas *et al.*, 2004; Bando *et al.*, 2020). HIV and HBV shared the same mode of transmission and HIV-HBV co-infection is relatively common. The problems of HIV-HBV co-infections vary largely on the route of HIV infection, been higher among injections, drugs users, and hemophiliacs compared with homosexual men (Thio *et al.*, 2002; Dharmadhikari *et al.*, 2004).

HIV infection and malaria are diseases of massive importance with over lapping distribution. The interaction between the two diseases have evolved over the last 5- 10 years, some of these interactions have dramatic-based effects and could be of great public health importance. Malaria and HIV could potentially interact in several ways, with effect upon transmission, clinical manifestation, and treatment outcome of either disease. In addition, there may be drug interaction and convergent toxicity between the drug used to treat each disease (Grimwalde, 2004; Patnack, 2005).

This research aimed at evaluating the prevalence of malaria parasitemia (mp) and Hepatitis B surface antigen (HBsAg) co-infection among HIV/AIDS patients in Taraba State, Nigeria.

MATERIALS AND METHODS

Specimen Collection and Preperation

For serum, blood was collected into the pipette without anticoagulant. The blood was allowed to clot and the serum was separated from the clot. The serum was used for testing. If the specimen cannot be tested on the day of collection, the specimen was stored in the refrigerator or freezer. The specimen is stirred and brought to room temperature before testing. The blood samples collected are that of the already tested and confirmed HIV/AIDS patients attending the clinic.

Malaria Parasite Test

The thumb of the patient is swabbed with 70% alcohol and prick with sterile needle. The blood is dropped on the slide and emulsified and then allowed to dry. The dried smear slide is covered with field stain A and allowed for about five seconds and then rinsed off with clean water. The smeared slide is again cover with field stain B and then rinse off immediately with clean water and the slide is then allowed to dry. After drying the slide was examined under the microscope using the oil immersion lens (xlOO) for possible parasites such as: *Plasmodium, P. falciparum, P. malarias, P. vivax and P. ovale.*

Hepatitis Test

One step strip style FIBsAg test is a rapid direct binding test for the visual detection of hepatitis B surface antigens (HBsAg) in serum as an aid in the diagnosis of hepatitis B infection. One step HBsAg test is based on the principle of sandwich immunoassay for determination of HBsAg in serum. Monoclonal and polyclonal antibodies are employed to identify HBsAg specifically. This one step test is very sensitive and only takes about 10-20 minutes. Test results are read visually without instrument.

RESULTS

Table 1: Age and sex distribution of HIV/AIDS patient in Government house clinic Jalingo, Taraba state

Age group	Total no. (%) of HIV/AIDS cases		Sex distribution Total (%) of cases Male		Female	
0-5	6.08		5(3.4)	7.25	4(2.7)	5.06
6-10						
11-15	4(2.7)		1(0.7)	1.45	3(2.0)	3.8
16-20						
21-25	3.38		2(2.0)	2.9	3(2.0)	3.8
26-30	9.46		4(2.7)	5.8	10(6.8)	12.66
31-35						
	25(16.9)	16.89	4(2.9)	5.8	21(14.2)	26.58
36-40						
41-45	41(27.7)		25(16.9)	36.23	16(10.8)	20.25
	15(10.1)	10.14	6(4.1)	8.7	9(6.1)	11.39
	16(10.8)		9(6.1)	13.04	7(4.7)	8.86
	19(12.8)	12.84	13(8.8)	18.84	6(4.1)	7.59
Total no. (%) cases	148%		69%		79%	

Table 2: Sex and age distribution of HIV/AIDS patient in Government house clinic Jalingo, Taraba State

Age group	Total no. (%) of malaria positive		Sex distribution Total (%) of cases Male		Female	
0-5	6(4.6)	5.26	4(2.7)	6.78	2(1.4)	3.64
6-10						
11-15	5(3.4)	4.39	3(2.0)	5.08	2(1.4)	3.64
16-20	3 (2.0)	2.63	1(0.7)	1.69	2(1.4)	3.64
21-25						
26-30	11(7.4)	9.65	3(0.2)	5.08	8(5.4)	14.55
31-35						
36-40	15(10.0)	13.16	3(0.2)	5.08	12(8.1)	21. 82
41-45						
	32(22.3)	28.07	21(14.2)	35.59	11(7.4)	20
	14(9.5)	12.28	6(4.1)	10.17	8(5.4)	14.55
	12(8.1)	10.53	7(4.7)	11.86	5(3.4)	9.09
	16(10.8)	14.04	11(7.4)	18.64	5(3.4)	9.09
Total no. (%)	114(77)		59(40)		55(37)	

Table 1 show the age and sex distribution of HIV/AIDS patients in Government House Clinic in Jalingo, Taraba state. There was no significant difference between sexes among HIV/AIDS patients attending the hospital. However, significant difference was noted among the different age groups of patients. Patients in the age group 26-30years were mostly in attendance when compared with other age groups (table 1). High percentage (78%) HIV/AIDS patients attending the Government House Clinic were positive to malaria, although there was no significant difference ($p>0.05$) in among the difference sexes in the prevalence of malaria (table 2). However, a positive correlation could be established in the age group of HIV/AIDS patience and prevalence of malaria. Highest prevalence of malaria (22%) was also found among the age group 26-30years similar to what was observed in the frequency of attendance of different age groups at the clinic (table 2).

Table 3: Sex and age distribution of HBsAg among HIV/AIDS patient in Govrnment house clinic Jalingo, Taraba State

Age group	Total no. (%) of Hepatitis B positive	Sex distribution Total (%) of cases	
		Male	Female
		Positive	Positive
0-5	1(0.7) 7.69	1(0.7) 14.29	0
6-10			
11-15	0	0	0
16-20	0	0	0
21-25			
26-30	2(2.4) 15.38	1(0.0) 14.29	1(0.7) 16.67
31-35			
36-40	2(1.4) 15.38	1(0.0) 14.29	1(0.7) 16.67
41-45			
	2(1.4) 15.38	1(0.0) 14.29	1(0.7) 16.67
	2(1.4) 15.38	1(0.0) 14.29	1(0.7) 16.67
	2(1.4) 15.38	1(0.0) 14.29	1(0.7) 16.67
	2(1.4) 15.38	1(0.0) 14.29	1(0.7) 16.67
Total no. (%)	13(8.8)	7(4.7)	6(4.1)

The assessment based on the distribution of hepatitis B surface antigen (HBsAg) among HIV/AIDS patient is shown in Table 3. The overall HBsAg prevalence was 13(8.8%).

There was insignificant prevalence of HBsAg from the age group 16-45 years. From the case investigated HBsAg is common among male than the female, although the difference is not statistically significant. In addition, Hepatitis B infection is not common within the age group of 0-15 while patient found to be suffering from hepatitis B infection were within the age group of 16-45 year.

Table 4: Distribution of HIV/AIDS patients based on occupation in Government house clinic Jalingo, Taraba State

Age group	Total no. (%) of positive cases	Sex distribution Total (%) of cases	
		Male	Female
Student	41(28.7	12(8.4) 17.39	29(20.3) 39.19
Business men			
Farmers	31(21.7)	22(15.4) 31.88	9(6.3) 12.16
Civil servant			
House wives	15(10.5)	15(10.4) 21.74	0
	36(25.2)	20(14) 28.99	16(11.2) 21.62
	20(14)	0	20(14) 27.02
Total no. (%)Cases	143(100)	69(43.3)	74(51.7)(47.6)

Analysis of the distribution HIV/AIDS patient by their occupation is shown in Table 4. Out of the 143 patients investigated 41(28.7%) were student, 31(21.7%) we business male and female, 15(10.5%) were farmers, 36(25.2%) were civil servant and 20(14%) were house wives. From the study, patients who were students had a higher prevalence of 9(6.3%).

Table 5: Distribution of HIV/AIDS patients based on marital status in Government house clinic Jalingo, Taraba State

Age group	Total no. (%) of positive cases	Marital status				
		Married		Single		
		Male	Female	Total no. of cases	Male	Female
0-5	0	0	0	6(4.0)	3(2.0)	3(2.0)
6-10						
11-15	0	0	0	4(2.7)	3(2.0)	1(0.7)
16-20	0	0	0	4(2.7)	1(0.7)	3(2.0)
21-25						
26-30	3(2.0) 3.95	0	3(2.0)	8(5.4)	3(2.0)	5(3.4)
31-35						
36-40	12(8.1) 15.79	1(0.7)	11(7.4)	15(10.1)	3(2.0)	12(8.1)
41-45						
	22(14.9) 28.95	18(12.2)	4(2.7)	19(121.8)	5(3.4)	14(9.5)
	11(7.4) 14.47	5(3.4)	6(4.0)	7(12.7)	4(2.7)	3(2.0)
	11(74) 14.47	6(4.0)	5(3.4)	4(2.7)	2(1.4)	2(1.4)
	17(11.5) 22.37	13(8.8)	4(2.7)	5(3.4)	1(0.7)	5(3.4)
Total no. (%) Cases	76(51.4)	43(29.1)	33(22.3)	72(48.1)	25(16.9)	47(31.7)

The distribution of HIV/AIDS patients by their marital status showed that 76(51.4%) were married and 72(48.6%) were single. The married couples were mostly affected. Higher prevalence were found in both married and single patients within the age group of 21-30 with 19(12.8%) and 18(12.2%), followed by married couple of age group 41-45 years who constituted 17(11.5%). Single patient (female) within the age group 6-15 and 41-45 years presented a very low incidence with only 8(5.4%) and 1(0.7%) respectively.

Table 6: Distribution of HIV/AIDS patients based on marital status in G.H.C Jalingo, Taraba State

Age group	Residential Location					
	Rural			Urban		
	Total no. (%) of cases	Sex Distribution Total No. (%) of Cases		Total No. of Cases	Sex Distribution Total (%) No. of Cases	
		Male	Female		Male	Female
0-5	2(1.7) 3.92	1(0.7)	1(0.7)	5(3.4)	3(2.0)	2(1.7)
6-10	4(2.7) 7.84	4(2.7)	0	1(0.7)	1(0.7)	0
11-15	3(3.0) 5.88	3(1.4)	0	3(3.0)	0	3(2.0)
16-20	4(4.7) 7.84	4(2.7)	3(2.0)	7(4.7)	3(2.0)	4(2.4)
21-25	4(2.7)27.45	4(2.7)	9(6.1)	11(7.4)	2(1.7)	9(6.1)
31-35	6(4.0)11.76	6(4.0)	10(6.8)	3(2.0)	1(0.7)	2(1.7)
36-40	4(2.7)7.84	4(2.7)	6(4.0)	5(3.04)	4(2.7)	1(0.7)
41-45	10(6.8)19.61	10(6.8)	3(1.4)	7(4.7)	4(2.7)	3(2.0)
Total (%)	96(61.4)	50(33.8)	44(27.7)	55(38.5)	26(17.6)	31(20.9)

Distribution of HlV/AIDS patient by their residential area was also observed, out of the 148 sample studied, 91(61.4%) of the patients reside in the rural areas while 57(38.5%) reside in the urban area. It was observed that male of both rural and urban area within the age group of 26-30 and 41-45 years presented a higher prevalence of 39% and 18.2% respectively while patients of both rural and urban area within the age group of 0-5 and 11-15 years are counted for a lower incidence rate with only 2.4% and 4% respectively.

DISCUSSION

Since Human Immunodeficiency Virus (HIV) cannot be called a particular diseases or infection, but it could rightly be referred to as a phenomenon or syndrome that breaks through the body defence mechanism gradually which exposes the body to all kind of diseases resulting in Acquired Immune Deficiency Syndrome (AIDS). At this stage the body is exposed to all kinds of infections including Malaria, Tuberculosis, Hepatitis, etc.

Despite plethora of campaign against this pandemic it has not been translated to behavioural change. The HIV/AIDS 4 scourge which is believed to be an African-Child, had gradually become a pandemic even the in the north -eastern part of Nigeria. Occurring

with it are other infections like malaria and Hepatitis and death toll has risen enormously because of people-refusal to accept its existence due to ignorance, stigmatization. Discrimination by members of community has increased denial on the part of those who have the disease, the inadequacy on the part of our health system (Hospital) to contend with the new wind of combat the scourge of the disease.

This Study focused on the prevalence of malarial and Hepatitis B surface Antigen (HBsAg) in people living with HIV. The result of the study has revealed that out of 148 patients with HIV tested, 114 (77%) tested positive for malaria. This implies that, malaria parasite infection is high among the patients studied and further confirmed endemicity of malaria in this environment. World Health Organisation (WHO) has estimated that 40% of the world population is at risk of malaria and there are between 350 and 500 million clinical cases every year (Greenberg *et al.*, 2005). There was a clear rural preponderance of malaria especially amongst women and children;' this was largely due to ignorance of this particular disease, its mode of infection, its causative agent and the preventive technique. Poverty plays a major role in the prevalence of these diseases in rural area, as care of environment to rid this parasite cost money. The purchase of insecticides and mosquito nets are also cost implicative, in areas where transfusion is unstable the parasite affects children and adult in different ways, children experience chronic recurrent parasitamia which could which could result in severe survived repeated infection acquired partial immunity, especially children at early age and carried through adulthood, while adults on

The other hand suffers from asymptomatic infections. In unstable transfusion area, immunity are not acquired, so the overwhelming clinical manifestation was acute disease which resulted in cerebral malaria and even death as reviewed by Grimwalde *et al.*, (2004). Malaria is highly prevalence among HIV/AIDS infected patients because both diseases could potentially interact in several ways with effect upon transmission, clinical manifestation, etc. Malaria is also very high in endemic areas because HIV disease impairs the acquired immunity to malaria, and as a major opportunistic infection, it can transiently increase viral load, and therefore could theoretically have an impact on HIV disease progression to AIDS and in transmission as Kustin *et al.*, (2006). People with the assymtomatic malaria infection experience about 6.25% increase viral load with fewer parasites density greater than 200. However, malaria may have an indirect effect on the risk of HIV transmission because anemia caused by *P falciparium* remains a frequent cause of blood transfusion. Kalyesubala *et al.*, (2000) ascertained 70% of children hospitalized for

malaria were transfused and there was a strong dose response between transfusion and HIV risk unsafe blood is responsible for 10,0000 new infections (Grimwlade *et al.*, 2003).

An association between HIV and occupation was evaluated, high risk occupation, based on the exposure to associated risk factor (student, civil servants and business men) accounted for high prevalence of 75.6%, while low risk occupation (housewives, and farmers) accounted for 24.5%. Students showed high prevalence for the sample reason that they always engaged themselves in premarital sex. Female students involved themselves in prostitution for financial gain and will always want to wear the latest clothing in town and be referred to as "one in town". The important role of hepatitis B virus (HBV) in the etiology of chronic liver disease has been well documented in many case-control studies worldwide. In Nigeria, chronic HBV is associated with 60-79% of liver cirrhosis and hepatocellular carcinoma. Evidence from the current study agrees with the previous findings on the high prevalence of HBV infection in HIV/AIDS patients.

Table 3 reveals that out of the 148 confirmed HIV positive patients tested, 13 tested positive to hepatitis B surface antigen (HBsAg) with a prevalence of 8.8%, and this showed that hepatitis B infection is also common among HIV infection patients. An HB infection is characterized by the persistence of HBsAg in the blood stream for over six months and is a major cause of chronic liver disease.

Although statistical analysis showed a low prevalence of HBV than the previous study, nevertheless, patients are still at risk of HBV infection. The study has been established association between HBV and HIV infection, (hepatitis B infection is independent of HIV), the carrier status of HIV patients could constitute on enormous reservoir of the virus, a source of infection for other and most importantly HBV infection could also cause a major problem in patients resulting in renal failure due to glomerulonephritis. Patients with renal failure mostly acquire HBV through blood transfusion.

Since HBV and HIV share the same mode of transmission, co-infection patients are relatively common. It is generally believed that those are actively involved in alcohol consumption (believed to be a stimulant) and sexually active are at risk of HIV and HBV infections. As revealed by Panicker *et al.*, (2021), HBV remains endemic in the rural area and this posing a serious challenging to the public health system. This could be a result of lack of awareness of the disease, it cause, and knowledge of the existence of the vaccine. Therefore the prevalence and clinical significant of the HBV in HIV infected patient is

controversial. By (Pessou *et al.*, 2005) HIV patients with hepatitis is bond o develop AIDS faster without proper education and care. With immunity, the veracity of the statement could be ascertained. Malaria and HBV in HIV infected patients accelerates the status of the patient from HIV and AIDS is less than no time especially if inadequate care, love and treatment are not administered. Human Immunodeficiency virus is immunosuppressive and reductive the competence of affected individual which make them susceptible to secondary infections by opportunistic microorganism such parasite, bacteria, Chlamydia, virus etc. the need for enlightenment to curtail the speed of HIV/AIDS, HBV and malaria infections is necessary in order forestall increase incidence of the infections.

Recommendation

From the result of this study, the government and others stake holders should embark on enlightenment campaign to educate the general public on those diseases. The rural areas have been greatly and painfully neglected in the fight against this scourge. The rural people lack functional hospital and most enlightenment campaigns are focused on urban area. The effective management of HIV in our local community is limited to lack of basic health care infrastructure.

Also unsafe blood transfusion is estimated to be responsible for 10,000 new infections annually; therefore practice of universal screening of blood should be implemented to improve the safety of blood supply so as to reduce the risk of Hepatitis B Virus (HBV) and Human Immunodeficiency Virus (HIV) infections.

The principle of roll back malaria programmed by the local community, the government and non-governmental organization should be implied. The programme should include in door residual spraying of insecticides on stagnant water around our environment and voluntary donation of treated mosquitoes nets should be provided to those in the rural area that cannot afford nets.

CONCLUSION

The result of this study has suggested the possibility of co-infection of HIV/AIDS parents with malaria and HBsAg. This phenomenon could increase the severity of HIV infection and facilitate the progression of HIV to AIDS. Human immunodeficiency Virus is immunosuppressive and reduces the immune-competence of affected individual which

make them susceptible to secondary infections by opportunistic microorganisms such as parasite, bacteria, Chlamydia, virus etc. the need for enlightenment to curtail the spread of HIV/AIDS, HBV and malaria infection is necessary in order forestall increased incidence of the infections.

REFERENCES

Alter, M.J. (2006). Epidemiology of viral hepatitis and HIV co infection. *J Hepatol.* 44(1):S6-9.

Alvarez-Uria, G., Ratcliffe, L. and Vilar, J.F. (2009). Long term outcome of tenofovir-disproxil fumarate use against hepatitis B in an HIV-infecetd cohort. *HIV Med.* 10:269-73.

Bani-Sadr, F., Palmer, P., Scieux, C. and Molina, J.M. (2004). Ninety-six-week efficacy of combination therapy with lamivudine and tenofovir in patients' co infected with HIV-1 and wild-type hepatitis B virus. *Clin Infect Dis*. 39:1062-4.

Bando, C. D., Tutuwa, A. J., Kefas, F., Jesse, S. P., Blessing Smart Aigbogun, S. B. and Garba, B. A. (2020). Prevalence of sickle cell disease/ABO blood group among secondary school students: A case study of government day secondary school (GDSS) mile six Jalingo, Taraba state, Nigeria. *International Journal of Advanced Scientific Research*. 5(6): 70-75.

Banhamou,Y., Bochet, M. and Martins. D. (2009). Liver fibrosis progression in HIV and HBV counteracted patients *Hepatology,* 30: 1044-1058.

Chung, B., *et al*., (2001); Human immune deficiency virus and Hepatitis B co-infection: pathogenic interaction, natural history and therapy. *AIDS clinical Rev*. 263-306

Dharmadhikari, C.A., Kullkarni, R.D., Udgaonkar, C. and Panlar, S.G. (2004). Incidence of hepatitis B surface antigen (HBSAg) in liver disease and voluntary blood donor. *Journal of medical Association;* 88(3): 73-75

Gashsau, A. (1991). Hepatitis B markers in Nigeria patients with primary liver cell carcinoma. *Trop Geog. Med.* 43:64-67.

Gerberging, J.L.(1999). Incidence and prevalence of Human Immunodeficiency virus, Hepatitis C and cytomegalo-vi rus among health personel at risk for blood exposure: final report from longitudinal study. *The journal infectious diseases*. 170-140-7.

Greenberg, A.E *et al.* (2005). Plasmodium facilparum malaria and perinally acquired Human Immnodeficiency virus type 1 infection in Kinshasa, Zaire. A prospective, longitudinal cohort study children. *N. Engl. Journal of Medical.* 325(2): 105, 2005.

Greenberg, A.E, Reddymm, Dewar, R. and Henrard, D. (2004). Increase prevalence of severe malaria and primary acquired Human Immunodefiecency Virus type 1 infection in Kinshasa, Zaire. A prospective, longitudinal cohort study of 587 children. *N. Engl. Journal of Medical.* 325(2): 105.

Grimwalde, A. (2004). HIV infection as a cofactor for severe falciparum malaria in adults living in region unstable malaria transmission in South Africa. AIDS 18(3): 547-554

Grimwlade, A.E., Lang, W. and Perkins, H. (2003). Childhood malaria in region of unstable transmission and Human Immunodeficiency virus prevalence. *Pediatric infectious Journal. 22(12): 1057-1063.*

Kalyesubala, M., Alger, *et al.*, (2000). Effect of malaria infection in Human Immunodeficiency Virus type 1 infected Angula children. *Pediatric infectious diseases Journal.* 16(9): 876-881.

Kao, J.H., Chen, P.J., Lai, M.V. and Chon, D.S. (2001). Occult Hepatitis B Virus infection and clinical outcome of patients with chronic Hepatitis B. *Journal of clinical* Microbiology. 40: 4068.

Panicker, S., Girish Kumar, C.P., Selvaraj, V., Prabu, R. *et al.* (2021). Molecular epidomology of HBV among HIV infected individuals in Chennai, South India. *Virus research.* 300:198439.

Pessou, L.D., Gazzard, W., Huang, A.B. (2005). Entecavir in HIV/HBV co-infection patients: safety and efficacy in phase II study (ETV-038). Programs and abstract of 12th conference on Retro-virus and opportunistic infection: February 22-25; *Boston Massachusetts.*

Razza, G. Dorcacci, M., Pezzotti, P. and Philips, L.A. (2002). Co-infection of Hepatitis B with Human Immunodeficiency virus infected and progression to AIDS. *Journal of infectious diseases. 172:1503-1508.*

Robins, K.E. (2003). Human Immunodeficiency virus type 1 epidemic: date of origin, population history and characterization of early strain. *Journal of Virology.* 77:6359-6366.

Slustakes, L. and Marston, B. (2006). HIV and malaria when elephant collide. This conference on Retroviruses and opportunistic infection, *Denver abstract 8.*

Thio, C.L. and Locamini, S. (2007). Treatment of HIV/HBV co-infection: clinical and virologic issues. *AIDS Rev.* 9:40-53.

Thio, C.L., Seaberg, E.C., Skolasky, R.L. *et al.* (2002). HIV-1, hepatitis B virus, and risk of liver related mortality in the multi-center AIDS cohort study (MACS). *Lancet.* 360:1921-1926.

Thomas, P., Douglas, M., Mark, N. and Justin, S. (2006). Hepatitis cellular cancer in HIV-infection individuals. *Expert Reviewed of Anticancer Therapy* 6:11, 553.

Villet, S., Pichoud, C., Billioud, G. *et al.* (2008). Impact of hepatitis B virus rtA181V/T mutants on hepatitis B treatment failure. *J Hepatol.* 48:747-55.

WHO. (2006). Antiretroviral therapy for HIV infection in adults and adolescents: recommendations for a public health approach. Geneva, Switzerland, 2006.

Wyles, D. (2008). Hepatitis virus co infection in the Strategic Management of Antiretroviral Therapy (SMART) Study: A marker for nonliver, non-opportunistic disease mortality. *Clin Infect Dis.* 47:1476-8.