PREVALENCE OF HBV CO-INFECTIONS WITH HCV AND HIV AMONG BLOOD DONORS IN ADO-EKITI, EKITI STATE, NIGERIA

Abstract

Blood is a life-saving resource. Despite the significance of blood transfusion in saving a millions life in emergencies and medical treatment, the safety of blood transfusion faced challenges of transmitting life threatening transfusion transmissible infectious agents such as hepatitis B virus (HBV), hepatitis C virus (HCV), and human immunodeficiency virus (HIV). The study was carried out to determine the sero-prevalence of HBV, HCV, HIV and co-infections among blood donors in Ado-Ekiti, Nigeria. A total of five hundred (500) prospective blood donors age ranged from 18 to 60 years attending Ekiti State University Teaching Hospital between May to November, 2019 were recruited for the study. Prospective study was based on questionnaires administered to generate socio-demographics and a 5ml venous blood samples were obtained from each blood donors and the plasma was used for determination of hepatitis B surface antigen (HBsAg) and anti-HCV using immunoassay rapid test kit (RTK) Diaspot, Belgium and HIV-1 and HIV-2 Determine Alere Medical ,Japan and further tested with enzyme linked immunosorbent assay (ELISA) Biorad Monolisa, France). The prevalence of HBV, HCV and HIV were 4.8%, 1.2% and 1.8% respectively, while co-infections with HBV/ HIV and HBV/HCV were 0.2% and 0.2% respectively and there was no case of triple infections among the blood donors. The incidence rate was high in HBV followed by HIV and HCV. The use of RTK and ELISA for screening of blood donor for HBsAg, anti HCV and HIV in terms of their sensitively and specificity showed that ELISA is more sensitive than RTK while RTK is more specific than ELISA. From the retrospective study age and gender distribution was not statistically significant ($P > 0.05$). A significance difference was observed between married blood donors and HIV infection ($P < 0.05$) and also blood donors with history of blood transfusion showed statistical significant to HBV and HCV ($P < 0.05$). The prevalence of HBV, HCV and HIV infections among blood donors were found to be statistically associated with smoking, alcohol consumption, surgical operation, multiple sex partners and tattooing ($P < 0.05$). This study shows that the prevalence of HBV infection in Ado-Ekiti, Ekiti State ,Nigeria was higher than HCV and HIV, hence

there is need to increase public awareness of the socio-cultural practices that contribute to the transmission of infection.

Keywords: Hepatitis B Virus, HIV, Hepatitis C Virus, co-infection, Ekiti, blood donor

Introduction

"Blood is a fluid medium in which blood corpuscles are suspended and circulate through the entire body. It is a specialized body fluid that supplies essential nutrients to the body cells and protects the body from infection and foreign bodies through the white blood cells. It is essential to life. Blood transfusion is an integral part of and life-saving procedure in modern medicine. However, it has the risk of transmitting life threatening transfusion–transmissible infectious agents such as human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV) and syphilis" (Jain, 2013). "Others include hepatitis D virus (HDV), human T cell lymphotrophic virus (HTLV), human pegivirus (HPgV), West Nile Virus (WNV), cytomegalovirus (CMV) etc" (Walana *et al*., 2014). "These transmissible infectious agents are among the greatest threats to blood safety for blood recipients" (Abate, 2016; Kakisingi *et al.,* 2016). "Thus, ensuring the safety of blood is a major concern in transfusion therapy. Transfusion-transmitted infections (TTIs) are a major problem associated with blood transfusion" (Sangite *et al*., 2013). "Accurate estimate of risk of TTIs are essential for monitoring the safety of blood supply and evaluating the efficacy of the currently employed screening procedures. Blood transfusion accounts for 5% to 10% of the transmission of HIV, infection in sub- Saharan Africa", (David *et al.,* 2018). "HBV, HCV AND HIV have gained a lot of attention in recent times because their impact goes beyond the infected person to affect even national economies" (Pennap *et al.*, 2016).

"Despite their biological differences they share common routes of transmission and risk factors. A total of 37 million of the global population were said to be living with HIV" (Ranjbar *et al.*, 2011). "The prevalence of HIV in Nigeria had varied from 1.8% in 1991 to 3.8% in 1993, 4.5% in 1999, 5.0% in 2003, 4.4% in 2005, 4.6% in 2008 and 4.1% in 2010. Hepatitis B and C viruses infect 350 and 170 million people around the world respectively. These viruses are a public health problem because they are responsible for the majority of the liver cancers in the world. More than 80% of those infected with the hepatitis C

virus are chronic carriers of the virus and a potential reservoir for transmission" (David *et al*., 2018). "Infections with hepatitis B virus and hepatitis C virus are a major global health problem and responsible for viral hepatitis in the tropics, especially in Nigeria" (Kiyosawa *et al*., 2005; Flinchman *et al*., 2014). "Moreover, infection with these viruses might be associated with increased morbidity rate as the infection may predispose to the development of serious liver diseases such as liver cirrhosis, liver failure and hepatocellular carcinoma" (Walter *et al.,* 2011). "The trio of HIV, HBV and HCV can be transmitted through direct contact with blood products, intravenous injections and unprotected sex with infected partner" (Andrade *et al.*, 2006). "The transfusion of blood and its products is a recognized risk factor for HBV, HIV and HCV" (Andrade *et al*., 2006; Al Abaddi *et al*., 2014; Flichman *et al*., 2014; Song *et al*., 2014; Zaheer *et al*., 2014).

"Hepatitis B virus infection remains one of the major global public health burdens. Global estimates suggest that more than 2 billion people have been infected with HBV, and 250 million of these people are chronically infected, of which 65 million live in Africa" (Ganem and Prince, 2004; Kramvis and Kew, 2007; Schweitzer *et al*., 2015). "HBV prevalence is highest in Sub-Saharan Africa and East Asia, where between 5–10% of the adult population is chronically infected. It accounts for 500,000–1.2 million deaths per year and is the tenth leading causes of mortality worldwide" (WHO, 2015; Blum, 2016). `

This study aimed to determine the sero-prevalence of HBV, HCV, HIV co-infection among blood donors in Ekiti State, identify existing socio-demographic patterns among blood donors with HBV, HCV and HIV co-infection and contrast the sensitivity and specificity of rapid test kit with ELISA as screening methods for blood donors.

Methodology

Sample Size and Subject-Sampling

The study included 500 consecutively- recruited blood donors aged 18 to 60 years, visiting the blood transfusion unit of Ekiti State University Teaching

Hospital Ado-Ekiti, Nigeria for blood donation purposes. Donors were screened for the presence of HBV, HCV and HIV.

Inclusion Criteria

Inclusion criteria included; age (18-60) years, willingness to give oral informed consent after counseling, non-breast feeding, non-menstruating women, no history of long- term medication use, and no history of blood transfusion within the last 3 months,

Administration of Questionnaire

A self-administered questionnaire was used to collect subjects' demographic and other relevant data, such as age, gender, socioeconomic situation (such as marital status, multiple sex partner and occupation), history of exposure to risky procedures or behavior, family history of HBV, HCV and HIV infection, and history of immunization against HBV

Sample Analysis

Subjects' blood samples were screened for HIV with a commercial rapid test-kit, Determine® HIV 1/2 manufactured by Alere Medical (Japan) using serial screening algorithm. Plasma samples that turn out to be positive were retested with another rapid test-kit, Uni-Gold® HIV 1/2 manufactured by Trinity Biotech (Ireland). Samples that are either negative or positive to both test kits were confirmed with enzyme linked immune-sorbent assay (ELISA) kit manufactured by Biorad Monolisa (France).

Screening of 500 blood donors for HBsAg and anti-HCV was done using rapid test kit Diaspot® manufactured in Belgium. Samples that are either negative or positives were confirmed with enzyme linked immune-sorbent assay (ELISA) kits (Biorad Monolisa, France).

Statistical Analysis

Descriptive and inferential analyses were carried on the data generated with the aid of statistical software SPSS Version 23.0 (Chicago, USA). Association between categorical variables were considered significant when $P < 0.05$.

Results

A total of five hundred (500) blood donors attending Ekiti State University Teaching Hospital Ado Ekiti, Nigeria were recruited for this study.

Table 1.,2 and 3 shows the seropositivity of HBV, HCV and HIV infection among the blood donors studied when rapid test kit (RTK) and enzyme linked immunosorbent assay (ELISA) was cross tabulated (4.8%), (1.2%) and (1.8%) respectively. The overall prevalence of HBV/ HIV and HBV/HCV co-infections were 0.2% and 0.2% respectively and no case of triple infections. The prevalence rate was high in HBV followed by HIV and HCV (Table .1).

Table 4, 5 and 6 presents association of categorical variable between socio demographic factors and HIV, HBV and HCV infections at $P < 0.05$.

The incidence of HIV, HBV and HCV was compared based on age, sex, marital status and blood transfusion. Age in this study did not show any statistical significant in age specific prevalence and gender was also not found to be associated with infection rate $P > 0.05$.while married subjects that were seropositive to HIV shows statistical significant with $P = 0.031$ but not significant to HBV and HCV with $P = 0.107$ and 0.483 respectively. There was significant association between blood transfusion and infection rate (Table 4).

Table 5 seropositive HIV, HBV and HCV was compared with skin tattoo and multiple sex partners, these shows statistical significant with $P < 0.05$. Those who had no knowledge of HIV shows statistical significant but were not found to be statistically significant in subjects who were seropositive to HBV and HCV .

Hard drug (injectible) users in this study was not found to be statistically significant with $P > 0.05$ but those who had sexually transmitted infection (STI) among blood donors were only positive to HBV shows statistical significant.(Table 5).

Table 6 presents association between cigarette smoking, alcohol usage, and surgical operation and HIV, HBV and HCV. A highly significant association was recorded between HIV, HBV , HCV and subjects that has undergone surgical operation with $P < 0.05$.

Alcohol usage subjects that were positive to HBV and HCV shows statistical significant with P = 0 and 0.008 respectively while those who smoke cigarette shows statistical significant to HBV with P = 0.002 (Table 6).

Table 1. HBV/RTK * HBV/ELISA Cross tabulation

	HBV/ELISA		Total
	Negative	Positive	
HBV/RTK Negative	476	23	499
Positive	0	1	1
Total	476	24	500
Proportion %	(95.2%)	(4.8%)	

Table .2 HCV/RTK * HCV /ELISA Cross tabulation

	HCV/ELISA		Total
	Negative	Positive	
HCV/RTK Negative	493	6	499
Positive	1	0	1
Total	494	6	500
Proportion %	(98..8%)	(1..2%)	

Table 3 HIV/RTK * HIV/ELISA Cross tabulation

	HIV/ELISA		Total
	Negative	Positive	
HIV/RTK Negative	491	9	500
Positive	0	0	0
Total	491	9	500
Proportion %	(98.2%)	(1.8%)	

Table 4. Association of Categorical Variables to HIV, HBV and HCV Infections at $p < 0.05$

		HIV		HBV		HCV	
Demographic Factors	Variables	Positive	Negative	Positive	Negative	Positive	Negative
Age	20 – 29	1	151	6	146	2	150
	30 – 39	6	248	17	237	1	253
	40 – 49	1	75	1	75	3	73
	50 – 59	1	17	0	18	0	18
	Total	9	491	24	476	6	494
	Chi square	2.932		6.614		5.362	
	P value	0.402		0.085		0.147	
	Remarks	Not Significant		Not Significant		Not Significant	
Sex	Male	7	310	16	301	5	312
	Female	2	181	8	175	1	182
	Total	9	491	24	476	6	494
	Chi square	0.88		0.117		1.173	
	P value	0.348		0.734		0.279	
	Remarks	Not Significant		Not Significant		Not Significant	
Marital Status	Single	0	190	6	184	1	189
	Married	8	269	18	259	5	272
	Divorced	1	29	0	30	0	30
	Other	0	3	0	3	0	3
	Totals	9	491	24	476	6	494
	Chi square	8.901		6.097		2.458	

	P value	0.031		0.107		0.483	
	Remarks	Significant		Not Significant		Not Significant	
Blood Transfusion	Yes	4	111	10	105	5	110
	No	5	380	14	371	1	384
	Total	9	491	24	476	6	494
	Chi square	2.049		4.351		9.964	
	P value	0.152		0.037		0.002	
	Remarks	Not Significant		Significant		Significant	

Table 5 Association of Categorical Variables to HIV, HBV and HCV Infections at $p < 0.05$.

		HIV		HBV		HCV	
Demographic Factors	Variables	Positive	Negative	Positive	Negative	Positive	Negative
Hard Drugs (injectibles)	Yes	0	39	2	37	0	39
	No	9	452	22	439	6	455
	Total	9	491	24	476	6	494
	Chi square	1.476		0.01		0.981	
	P value	0.224		0.921		0.322	
	Remarks	Not Significant		Not Significant		Not Significant	

Skin Tattoo	Yes	4	57	9	52	4	57
	No	5	434	15	424	2	437
	Total	9	491	24	476	6	494
	Chi square	5.928		10.761		9.917	
	P value	0.015		0.001		0.002	
	Remarks	Significant		Significant		Significant	
Multiple Sex Partners	Yes	7	48	19	36	4	51
	No	2	443	5	440	2	443
	Total	9	491	24	476	6	494
	Chi square	23.761		67.402		11.303	
	P value	0		0		0.004	
	Remarks	Significant		Significant		Significant	
STI	Yes	3	53	12	44	1	55
	No	6	438	12	432	5	439
	Total	9	491	24	476	6	494
	Chi square	3.186		24.056		0.162	
	P value	0.074		0		0.687	
	Remarks	Not Significant		Significant		Not Significant	
Knowledge of HIV Status	Yes	0	237	9	228	3	234
	No	9	254	15	248	3	237
	Total	9	491	24	476	6	494
	Chi square	13.39		3.835		0.569	
	P value	0.001		0.147		0.752	
	Remarks	Significant		Not Significant		Not Significant	

Table 6 Association of Categorical Variables to HIV, HBV and HCV Infections at $p < 0.05$.

		HIV		HBV		HCV	
Demographic Factors	Variables	Positive	Negative	Positive	Negative	Positive	Negative
Cigarette Smoke	Yes	1	41	7	35	0	42
	No	8	450	17	441	6	452
	Total	9	491	24	476	6	494
	Chi square	0.08		9.391		1.06	
	P value	0.777		0.002		0.303	
	Remarks	Not Significant		Significant		Not Significant	
Alcohol Usage	Yes	8	149	20	137	5	152
	No	1	342	4	339	1	342
	Total	9	491	24	476	6	494
	Chi square	13.263		29.262		7.022	
	P value	0		0		0.008	
	Remarks	Significant		Significant		Significant	
Surgical Operation	Yes	8	90	11	87	5	93
	No	1	401	13	389	1	401
	Total	9	491	24	476	6	494
	Chi square	20.743		8.958		11.516	
	P value	0		0.003		0.001	
	Remarks	Significant		Significant		Significant	

Discussion

"Blood represents a non-alternative life-saving therapy used to reduce morbidity and save thousands of lives every year" (Lavanya, *et al., 2012).*"It carries the risk of transmitting life threatening transfusion transmissible infectious agents such as human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), and syphilis" (Jain, 2013). "These transmissible infectious agents are among the greatest threats to blood safety in blood recipients" (Abate, 2016 and Kakisingi *et al*, 2016). However, the spread of blood borne viruses especially HBV, HCV and HIV, increases at an alarming rate worldwide, and this created impact upon some countries such as Nigeria. Global estimate that more than 2 billon people have been infected with HBV and 250 million of these people were chronically infected of which 65 million live in Africa (Kranvis and Kew, 2007 and Schweitzer *et al*, 2015) and 200 million people were infected with HCV (Zaheer *et al*., 2014). According to World Health Organization in 2016, 37 million people were living with HIV/AIDS worldwide of which 70% or 25 million people live in resource poor countries (WHO, 2016). Nigeria has the second largest HIV epidemic in the world (WHO, 2017). The seroprevalence for Ekiti State was one percent in 2008 and increased to 1.4% 2010 more in urban and less for rural areas (EKSACA, 2010). According to the HIV/AIDS ranking by State published by National Agency for the controls of AIDS (NACA) after the 2013 National AIDS Reproductive Health Survey, Ekiti State was reported to have the lowest rate of HIV prevalence in Nigeria 0.2% compared to other States (NACA, 2015). The purpose of this study was to determine the occurrence of HBV, HCV and HIV infections by combination of serological and genotypic methods, to identify existing socio-demographic patterns among blood donors with HBV, HCV, HIV and co-morbidity and to compare RTK with ELISA for screening of blood donors for HBsAg, Anti- HCV and HIV in terms of their sensitivity and specificity. In this study, the occurrence rate of seropositivity of HBV infected blood donors was 4.8%. This is in agreement with the study carried out among blood donors in North west Ethiopia by Belay *etal*., (2010), Awoleke, (2012) in Ekiti State and David *et al*., (2018) in Democratic Republic of Congo, However, the occurrence of HBV observed in this study was considerable high compared to that observed by Singh and Sharma, (2008), Adekunle *et al*.,(2011) and Krunal *et*

al., (2013). However, when compared with global prevalence of chronic HBV infection category, it is within the range of intermediate clusters (2—7%) indicating that HBV is common in the study area (Quadri *et al*., 2013). The HCV of 1.2% observed in this study is in agreement with the study carried out among potential blood donors in Ibadan Nigeria by Afolabi *et al.,* (2013), Esan *et al.,* (2014) and Akinbolaji *et al.,* (2015). The occurrence of HIV was 1.8%. This was similar to the findings of Ejele *et al*., (2005) and Ambachew *et al.,* (2018) but much higher than 0.2% obtained in Ekiti State by NACA, (2015). However, the prevalence observed was lower than the National value of 5.8%, 5.0% and 5.2% in 2001, 2004 and 2008 respectively in a sentinel survey by the Federal Ministry of Health in 2009 (Federal Ministry of Health Nigeria Technical Report, 2010).

The overall prevalence of HBV/ HIV and HBV/ HCV co-infection were 0.2% and 0.2% respectively. Although there was no case of triple infection among the blood donors and this was similar to the finding of Buseri *et al*., (2009) in South- west, Nigeria. However, the occurrence of co-infection observed in this study could be because these infections share similar mode of transmission and risk factors (Nwankwo *et al*., 2012), hence case of co-infection especially HIV and hepatitis in endemic areas. However, some researchers posited that transmission efficiency is determined by the amount of virus in a body fluid and the type and extent of contact (Eze *et al.,* 2014). Although there was no case of triple infection among the blood donors and this was similar to the finding of Buseri *et al*., (2009) in South-- west, Nigeria.

The comparison between RTK and ELISA for screening of blood donors for HBsAg, anti- HCV and HIV in terms of their sensitivity and specificity. It was found that ELISA was more sensitive than RTK while RTK was more specific than ELISA. This was similar to the findings of David *et al.,* (2018) in Democratic Republic of Congo who reported that there is limitation in the use of rapid diagnostic test in diagnosis of these different post transfusion infections.

The age and gender distribution in this study did not show any statistical significant with infection rate with $P > 0.05$. This was in an agreement with the research carried out among blood donors in South-west Nigeria by Mabayoje *et al.,* (2007), who reported that the prevalence of HBV and HCV marker did not differ significantly with gender or age group. It was observed that married blood donors were statistically significant to HIV infection with $P < 0.05$. This could be as a result of unprotected sex which is known to be a means of

transmission of HIV and marriage provides a means of unprotected sex which could increase the chances of exposure and transmission of HIV and probably they do not understand the consequences of unprotected sex (Ali *et al.,* 2019). It was observed that some of the blood donors who had history of blood transfusion were positive to HBV and HCV which was statistically significant with $P < 0.05$. This was in agreement with the report of several researchers who reported that transfusion of blood and its products is recognized risk factor for HBV and HCV (Andrade, 2006, Al-Abaddi *et al.,* 2014, Song *et al.,* 2014 and Zaheer *et al.,* 2014). In addition, each blood transfusion carries a risk of transmitting blood-pathogens (Tyagi and Tyagi, 2013). For instance, in sub-Saharan Africa, 5—12% of patients who received blood transfusions are at risk of post-transfusion hepatitis and HIV infections (Nagalo *et al*., 2011). Drug users are at high risk of blood borne viral infection due to sharing of contaminated needles (Parry, 2010). It was found in this study that none of the HBV , HCV and positive subjects admitted the use of drugs. This might due to the embarrassment of admitting using such drugs due to social stigma associated with such a habit.

.Risk factors associated with transmission of HIV, HBV and HCV were observed in this study such as smoking, alcohol consumption, surgical operation, multiple sex partners and tattooing were statistically significant with $P < 0.05$. This showed that there was a similarity between risk factors and route of transmission between HIV, HBV and HCV, It was found in the present study that the prevalence of HBV was higher as compared to HCV and HIV. Several studies also come up with similar findings compared with the present study (Abu *et al*., 2009 Arora *et al*., 2010, Fessehaye *et al*., 2011, Adekeye *et al*., 2013, Fatemeh *et al*., 2016 and Biadgo *et al*., 2017). The probable reason for this high prevalence may be due to higher infectivity of HBV compared to HCV and HIV as well as lack of awareness of the community towards hepatitis transmission and prevention.

CONCLUSION

This study confirms that infection transmitted by blood transfusion are a public health problem considering the prevalence rate of HBV, HCV and HIV (4.8%, 1.2% and 1.8%) respectively. The result also shows that there is a significant association between risk factors and infection rate. It is clearly shows that hepatitis B infection is commoner than hepatitis C and HIV infection among

Ekiti people. The results also need to consider subtypes of HBV infection in the investigation of blood donors presenting with the HBV related illness.

RECOMMENDATION

AIDS and hepatitis have few things in common. Both are viral infections, still incurable and most importantly they are transfussible. This therefore makes it very imperative to thoroughly screen prospective blood donors for HIV and hepatitis. Therefore the following are recommended:

- Proper hepatitis and HIV counseling person sexual partners should know about others hepatitis and HIV status. Therefore disclosing this information gives the person with any types viral hepatitis and HIV legal protection and allows others to make their own decision.
- Regular exercise is also important exercise can boast immune function stimulate the appetite and improve mental health and prevent constipation.
- Avoid sharing of drug needles, razors, excessive alcohol consumption, touching spilled blood, someone else tooth brush, tattooing and multiple sex partners. So that person can be protected from been infected with HIV or hepatitis.
- Everybody should be advised on hepatitis and HIV self testing as Nigeria aims to reach the UNAIDS target, with 90% of people living with HIV and viral hepatitis knowing their status by 2021.

Ethical Approval

Approval and ethical clearance of the study was obtained from the Ethics and Research Committee of Ekiti State University Teaching Hospital Ado-Ekiti, Ekiti State Nigeria (Protocol Number: EKSUTH/A67/2019/05/006).

Consent

As per international standards or university standards, patient(s) written consent has been collected and preserved by the author(s).

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