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Research Article

HIV Seroprevalence among Blood Donors in Ilorin, Nigeria

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Abstract

Introduction: Human immunodeficiency virus (HIV) can be transmitted through blood transfusion. It is therefore important to screen all blood donors properly for HIV in order to ensure the safety of all blood products that will be transfused into recipients.

Aims and Objective: The aim of this study was to determine the prevalence of HIV infection among the different types of blood donors visiting the University of Ilorin Teaching Hospital (UITH), and also to determine the age range and sex of HIV positive blood donors.

Method: Observational cross-sectional study among blood donors at the blood bank of UITH. A total of 208 donors were screened for HIV using GenscreenTM ULTRA HIV-1 Ag/Ab EIA kits. A total of 164 (78.8%) donors were family replacement, 27 (13%) were paid while 17 (8.2%) were voluntary unremunerated.

Result: The overall prevalence of p24 antigen was 6.7%. There was no prevalence among females, all the positive donors were males, and they all fell within the 21-40 years age group. Prevalence of p24 antigen was significantly higher among paid donors (11.1%) compared to family replacement donors (6.7%) and voluntary donors (0%) (P = 0.002).

In conclusion, this study showed a high prevalence of HIV infection in the studied population, exclusively among paid and family replacement donors. There is therefore a need for proper screening of blood donors as well as encouraging voluntary blood donation in order to ensure the safety of transfused blood products.

ABBREVIATIONS

HIV: Human Immunodeficiency Virus; EIA: Enzymes Immunoassays; AIDS: Acquired Immune Deficiency Syndrome; UITH: University Of Ilorin Teaching Hospital; NAT: Nucleic Acid Test; WHO: World Health Organization.

INTRODUCTION

Transfusion of Human Immunodeficiency Virus (HIV) infected blood is one of the most effective ways of transmitting HIV [1]. Research shows that those transfused with blood contaminated with HIV have at least 90% chance of becoming infected [1]. World Health Organization (WHO) estimates that about 5-10% of HIV infections worldwide have been acquired through transfusion of infected blood and blood products [2]. Each year, up to 13 million units out of more than 75 million units of the global blood supply are not screened for HIV or other transfusion-transmissible infections [2]. Most of these unscreened blood and blood products come from and are transfused in Sub-Saharan Africa [2]. In addition, Sub-Saharan Africa bears the greatest burden (in terms of epidemic proportions, acquisition of new infections, and mortality) of HIV and AIDS in the world [3].

According to WHO estimates, of the 112.5 million blood donations made in 2013, only 5.6 million (accounting for only about 4% of global donations) were made in Africa. The median donation rates per 1000 samples in lower middle income and low-income countries, which largely make up sub-Saharan Africa, were 7.8 and 4.6 respectively [4]; this shows that availability of blood in Africa and her sub-Saharan region is grossly inadequate. Collection of donor blood in sub-Saharan Africa is mainly hospital-based and is largely from family replacement donors and commercial remunerated donors. These family replacement donors are usually under undue pressure to donate and might not reveal any risky behaviour during donor selection. Also, they are typically at a greater risk of HIV infection than voluntary non-remunerated donors [5].

Nigeria has the twenty-first highest adult HIV prevalence rate (2.9%) and the second-largest HIV epidemic in the world [6,7]. As at 2015, about 3.5 million people were reported to be living with HIV in the country [8]. It has been reported that Nigeria together with Uganda and South Africa account for almost half of all new HIV infections in sub-Saharan Africa every year [3]. Studies have also shown that transfusion-transmitted HIV infection persists in sub-Saharan Africa, with a high incidence among pregnant women due to haemorrhage-related anaemia and in children with malaria-related anaemia [9].

In a previous study conducted in a teaching hospital in Sokoto, North West Nigeria, from 2010 – 2013, the prevalence of p24 antigen in HIV seronegative blood donors was 5.84% [10]. Another study conducted in Enugu, South-East Nigeria in 2009 showed the incidence of transfusion-related HIV infection to be 1.2% [11]. Other studies from South-West Nigeria, in Ile-Ife and Ibadan, also reported transfusion-related HIV infection in children [12,13].

Therefore, it is imperative to assess the safety of blood transfusion especially in centers where transfusion occurs on a daily basis. The University of Ilorin Teaching hospital is a major tertiary health center in the North central region of Nigeria where, like most tertiary health centers in the country, blood transfusion is often an urgent clinical decision. In addition to this, resources are usually limited. This usually leads to an almost exclusive reliance on rapid diagnostic testing (Rdt), which is antibody based, for donor screening. This practice of over-reliance on rapid diagnostic kits often misses out donors in acute phase of HIV infection. This puts recipients of blood transfusion at a high risk of HIV infection when they are transfused with blood from such donors. The objective of this study is to determine the seroprevalence of p24 antigen among HIV seronegative blood donors in university of Ilorin teaching Hospital.

MATERIALS AND METHODS

Study design and location

This was an observational cross-sectional study designed to determine the prevalence of HIV infection among the various classes of blood donors visiting the University of Ilorin Teaching Hospital (UITH) blood bank as well as the age range and sex of HIV positive blood donors.

University of Ilorin Teaching Hospital (UITH) is located within the central senatorial districts, in Ilorin East local government area of the state. It renders both in-patient and outpatient specialist care services and has many clinical and non-clinical departments. A 640-bedded facility serves as a referral center for patients within and outside the state.

Study population

The participants are male and female blood donors in the hospital's blood bank domiciled within the hematology department of the hospital.

Sample size determination

The required sample size was calculated using Fischer's statistical formula for estimating minimum sample size in descriptive health studies [14]. A prevalence rate of 5.8% was used [15].

The total annual number of donors seen in the blood transfusion unit of UITH was not up to 10,000 as at the time of study. Therefore, using a correction factor (nf), a minimum sample size of 84 was obtained.

However, a sample size of 208 (191 (92%) family replacement and paid donors and 17 (8%) voluntary non-remunerated donors) was used in this study so as to have more data, ensure a more precise estimate, and ultimately reduce the margin of error.

Laboratory procedure

All classes of donors were considered in this study. However, other criteria for donor selection were predominantly based on WHO guidelines.

A structured questionnaire, specifically designed for this study and based on WHO donor selection criteria, was administered to the donors. Sociodemographic information, including age, tribe, gender, religion, level of education and occupation was obtained from the questionnaire

Sample collection, transport and storage

Participants were asked to sit comfortably with the forearm extended. A tourniquet was tied about 5-10 cm above the cubital fossa and the antecubital region was properly cleaned with cotton wool dipped in 70% alcohol solution, after which the region was wiped dry with a clean dry cotton wool. A plain, anticoagulant-free, Vacutainer tube, together with the tube holder and needle was inserted into an antecubital vein and 5 mls of blood was collected. The samples were transported to the laboratory immediately where the sera were separated by centrifugation. The separated sera were pipetted into plain sera bottles and Rdt for HIV antibodies was perfomed. Also, Rdt was performed to rule out other transfusion transmissible infections like Hepatitis B, C and Syphilis. The sera were then stored and kept frozen at -20 to -25°C until they were assayed for p24 antigen about a month later.

Rapid diagnostic test for HIV-1/2 antibodies

A micropipette was used to add 50µl of the already separated test serum onto the end of the Alere™ Determine™ strip that is designed for the test sample. The above step was replicated using CHEMBIO HIV-1/2 STAT-PAK. The test was left for at least 15 minutes (results are produced within 15 -30 minutes). After the specified period of time, the result was read. Negative samples are indicated by reaction at the control window only while positive samples are indicated by double reaction at both test and control windows. Any reaction outside these is invalid.

HIV p24 antigen assay

Conjugate 1 was added into the microplate wells. Serum samples to be assayed and controls were pipetted into the wells. (If present, HIV antigens bind to the solid phase coated with monoclonal antibodies and the conjugate 1. HIV-1 and/or HIV-2 antibodies, if any, bind to the antigens immobilized on the solid phase. Also, deposition of conjugate 1 and sample is validated through a colour change, from yellow-green to blue). After incubation at 37°C and washing, conjugate 2 was added: streptavidin reacts with biotinylated Ab-Ag-Ab complexes; peroxidase labeled, purified HIV-1 and HIV-2 antigens bind in turn to the IgG, IgM or IgA antibodies captured on the solid phase. After incubation at 18-30°C the unbound conjugate 2 fraction was removed by washing. After incubation in presence of the substrate at room temperature (18-30°C) the presence of the complexed conjugate was shown by a change in colour. The reaction was stopped and absorbances were read using a spectrophotometer at 450/620-700 nm. The absorbance measured on a sample determines the presence or absence of HIV Ag.

Ethical Approval

Ethical approval was obtained from Health Research and Ethics Committee of University of Ilorin Teaching Hospital, Reference No- ERCPAN/2017/10/1756. Also a written informed consent was obtained from the study participants. The informed consent form contained the following information: names and affiliation of investigator, description of the study in plain and simple language, duration of the study, statement of confidentiality including the right of the participant to withdraw from the study at any time, ethics committee approval.

Data Analysis

Biodata, sociodemographic findings and laboratory results were recorded in the study proforma. Data collected from the study proforma were entered using numeric codes on Microsoft Excel spreadsheet. Data obtained were analyzed using the statistical package for the social sciences version 22 computer software. Descriptive statistics was depicted using absolute numbers, simple percentages, mean and range. Cross tabulations and chi-square were used to analyze and compare relationship between variables. The level of statistical significance was set at 95% confidence interval ($P \leq 0.005$). Conclusion and recommendations were based on evidence from the study.

RESULTS AND DISCUSSION

Sociodemographic characteristics of study population

Tables 1 and 2 show the sociodemographic characteristics of the study population.

The mean age and age range of blood donors were 30.5 ± 8.1 and 18-57 years respectively. The study population was made up of 204 (98.1%) males and 4 (1.9%) females; 76 (36.5%) and 132 (63.5%) practice Christianity and Islam respectively, 107 (51.4%) were single while 101 (48.6%) were married.

16 (7.7%) of the donors had primary education, 60 (28.8%) had secondary education, 128 (61.5%) had tertiary education while 4 (1.9%) had no formal education. Also, 184 (88.5%) were Yoruba; 7 (3.4%) were Igbo, 2 (1%) were Hausa. Three (1.4%) and 2 (1.0%) were from Fulani and Nupe tribes respectively while 10 (4.9%) belonged to other tribes. Furthermore, 138 (66.3%) of the donors were employed while 70 (33.7%) were unemployed.

Prevalence of HIV infection by p24 assay

The seroprevalence of p24 antigen among the study population with the fourth generation Genscreen™ ULTRA HIV Ag-Ab EIA kit for p24. Fourteen out of the 208 individuals recruited for the study were repeatedly positive for p24. This puts the prevalence at 6.7%. This is shown in Table 3.

Proportion of types of blood donors in the study population

The study population consisted of 164 (78.8%) family replacement donors, 27 (13%) paid donors and 17 (8.2%) voluntary non-remunerated blood donors. This is demonstrated in Table 4

Distribution of p24 antigen among study population

All the 14 donors who tested positive for p24 antigen fell within the 21-40 years age group and were males. However, there was no significant association between p24 antigen positivity and the age group ($P = 0.067$) as well as sex ($P = 0.603$) of the study population.

Furthermore, all the p24 antigen positive donors belonged to the Yoruba tribe and were predominantly Muslims (12); only two were Christians. Nine (64.3%) of the total number of p24 antigen positive donors were single while 5 (35.7%) were married. Also, p24 antigen positivity occurred more among unemployed

Table 1: Distribution of the study population based on age, sex, religion and marital status.

Age	Frequency	Percent %	Valid %	Cumulative %
≤ 20 years	7	3.4	3.4	3.4
21-40 years	182	87.5	87.5	90.9
41-60 years	19	9.1	9.1	100.0
Total	208	100.0	100.0	
Mean age – 30.5 ± 8.1**, range** 18 – 57 years				
Sex				
Female	4	1.9	1.9	1.9
Male	204	98.1	98.1	100.0
Total	208	100.0	100.0	
Religion				
Christianity	76	36.5	36.5	36.5
Islam	132	63.5	63.5	100.0
Total	208	100.0	100.0	
Marital status				
Single	107	51.4	51.4	51.4
Married	101	48.6	48.6	100.0
Total	208	100.0	100.0	

Table 2: Distribution of the study population based on education, tribe and employment status.

Educational level	Frequency	Percent (%)	Valid (%)	Cumulative (%)
Primary	16	7.7	7.7	7.7
Secondary	60	28.8	28.8	36.5
Tertiary	128	61.5	61.5	98.1
None	4	1.9	1.9	100.0
Total	208	100.0	100.0	
Tribe				
Yoruba	184	88.5	88.5	88.5
Igbo	7	3.4	3.4	91.9
Hausa	2	1.0	1.0	92.9
Fulani	3	1.4	1.4	94.3
Nupe	2	1.0	1.0	95.3
Ebira	2	1.0	1.0	96.3
Igala	3	1.4	1.4	97.7
Others	5	2.4	2.4	100.1
Total	208	100.1	100.1	
Employment status				
Employed	138	66.3	66.3	66.3
Not employed	70	33.7	33.7	100.0
Total	208	100.0	100.0	

Table 3: Prevalence of p24 antigen.

P24		Frequency	Percent	Valid Percent (%)	Cumulative Percent (%)
	Negative	194	93.3	93.3	93.3
	Positive	14	6.7	6.7	6.7
	Total	208	100.0	100.0	100.0

Table 4: Proportion of types of blood donors in the study population.

		Frequency	Percent (%)	Valid Percent (%)	Cumulative Percent (%)
Valid	FRP	164	78.8	78.8	78.8
	VOL	17	8.2	8.2	87.0
	PD	27	13.0	13.0	100.0
	Total	208	100.0	100.0	

**FRP – family replacement donor, PD – paid donor, VOL- voluntary donor*

donors (6). However, p24 antigen positivity was not significantly associated (P > 0.05) with the tribe, religion, marital status or employement status of the donors.

Paid donors had the highest prevalence of p24 antigen (11.1%) followed by family replacement donors (6.7%). There was zero prevalence among voluntary non-remunerated donors. Also, the prevalence of p24 antigen positivity was higher among donors with primary education (18.8%) than other educational groups: tertiary (7.0%) and secondary (3.3%). There was zero p24 antigen prevalence among donors with no formal education. However, the prevalence of p24 antigen was not significantly associated with the level of education (P = 0.303). Further details are shown in table 5.

DISCUSSION

Transmission of HIV by transfusion of blood and blood products still carries a high risk in Sub-Saharan Africa[2] compared to most developed countries of the world, where infection is detected much earlier through the use of p24 antigen and Nucleic acid testing (NAT) [16]. Although, NAT detects acute HIV infection earlier than p24 antigen screening, screening for the antigen still offers the benefit of reduction in the window period by about one to two weeks [17].

This study observed that p24 antigen positivity occurred only among people aged between 21-40 years. This finding is consistent with those from similar studies by Kwaru et al., in Kano, North Western Nigeria [18], and Japhet et al., in Ile-Ife

Table 5: Comparison of p24 antigen positivity with sociodemographic variables and other parameters of the study population.

Variables	Number (n)	(n) positive for P24 antigen	(%) positive for P24 antigen	(n) negative for P24 antigen	X^2	P value
Age Group						
< 20yrs	7	0	0	7	2.645	0.067
21-40yrs	182	14	6.7	168		
41-60yrs	19	0	0	19		
Sex						
Male	204	14	6.7	190	0.271	0.603
Female	4	0	0	4		
Marital Status						
Single	107	9	8.4	98	0.404	0.956
Married	101	5	5.0	96		
Religion						
Christianity	76	2	2.6	98	2.849	0.61
Islam	132	12	9.1	120		
Tribe						
Yoruba	184	14	7.6	170	1.929	0.197
Igbo	7	0	0	7		
Hausa	2	0	0	2		
Fulani	3	0	0	3		
Nupe	2	0	0	2		
Others	10	0	0	10		
Occupation						
Not Employed	58	6	10.3	52	13.792	0.841
Artisan	41	3	7.3	38		
Students	12	2	16.6	10		
Teaching	11	2	18.0	9		
Military	3	1	33.3	2		
Others	93	0	0	93		
Types of donor						
FRP	164	11	6.7	153	1.866	0.002
PD	27	3	11.1	24		
VOL	17	0	0	17		
Level of Education						
Primary	16	3	18.8	13	3.639	0.303
Secondary	60	2	3.3	58		
Tertiary	128	9	7.0.	119		
None	4	0	0	4		

** FRP – Family replacement donor, PD – Paid donor, VOL – Voluntary donor, X^2 – Chi-square, level of significance – P value < 0.05*

South Western Nigeria [19]. Kwaru et al., reported the highest p24 antigen positivity in the 31-40 years age group while Japhet et al reported the highest prevalence in the 18–30 years age group. These age groups represent the youths, who are the most sexually active age group of any population and are more disposed to certain high risk behaviours such as keeping multiple sex partners, engaging in casual sex and wild sex adventures, having unprotected sexual intercourse, tattooing, intravenous drug abuse, alcoholism, than any other age group within a population. This observation is worrisome since the most active and productive group of the population is most affected.

p24 antigen positivity was observed, in this study, to be more among single donors than married donors, a finding consistent with a similar study conducted in Sokoto Northwest Nigeria [20]. However, there was no significant association between the donors' marital status and p24 antigen positivity (P = 0.956).

p24 antigen positivity, among the study population, occurred only among male donors. This finding is consistent with observations from similar studies done in the country [18,21], but at variance with other similar studies that were also conducted in the country [22]. The fact that females are usually excluded from blood donation due to normal physiological states like pregnancy and lactation tilts the scale towards men as regards blood donation. However, this difference is more pronounced here in Nigeria where in addition to above, certain bias like, undue masculinization of blood donation, discouraging women from donating blood because of menstruation, religious and certain cultural practices, are employed as tools to prevent women from donating blood. This may explain why there are always more male donors compared to females.

However, there was no significant association between the gender of donors and p24 antigen positivity (0.603) in this study. It was observed that all 14 donors who were confirmed positive for p24 antigen were either family replacement or paid donors; with the highest prevalence observed among paid donors (11.1%). A similar finding was observed in a study done in Northern Thailand which reported that HIV-1 seropositivity was highest among professional paid donors. The study also reported that HIV prevalence dropped in the region after discontinuation of the use of paid donors [20]. Fiekumo et al., Ejele et al., in similar studies conducted at Osogbo South Western Nigeria, Port Harcourt South Southern Nigeria at different times respectively, also observed that the prevalence of transfusion-transmissible HIV infection was higher among commercial paid donors [23,24]. In a study conducted by Osaro et al., in Sokoto Northwestern Nigeria, it was observed that all seven donors that were seropositive to HIV were family replacement donors [25]. This observation is at slight variance to that obtained in this study, where even though eleven of the fourteen p24 antigen positive samples were from family replacement donors, the prevalence of the antigen (11.1%) was higher among paid donors. This difference in observations is most likely due to the fact that paid donors were not part of the studied population in the research conducted by Osaro et al. The larger proportion of blood supply in most tertiary health centres in the country come from family replacement and paid donors [26,27]. Olawumi et al., reported that most of the blood donors from University of Ilorin Teaching Hospital, where this study was carried out, were family replacement donors [26]. This could explain the reason for the high number of blood donors and consequently the higher frequency of p24 antigen in that category as shown in this study. However, the prevalence of the antigen was more among paid donors which is interesting because this class of donors is hardly encountered in the hospital. This may be due to the fact that some of the so-called family replacement donors may actually be paid donors who hide their true identity and take advantage of the usually desperate and extremely urgent situation under which blood transfusion is often carried out (as is the case in most clinical settings in Nigeria) in the hospital.

Transfusion of blood collected from either a family replacement or paid donor carries a significantly higher risk of HIV transmission than blood donated by voluntary non-remunerated donors [5]. In the Sub-Saharan African setting including Nigeria, prospective blood donors who are usually either family replacement or paid donors, seldom give correct information about their risky behavioural practices even in health facilities where the donor questionnaire is strictly enforced [5]. Also most of these type of donors, especially paid donors, are usually from impoverished parts of the community. They are more likely to be poorly nourished and often tend to donate blood more than is recommended. In addition, most of them do not usually pay attention to their social behaviour and are more likely to engage in high risk practices like keeping multiple sexual partners, having casual unprotected sexual intercourse and intravenous drug abuse [28,29].

This study also observed zero prevalence of p24 antigen among voluntary non-remunerated blood donors. This observation is similar to that reported by Osaro et al in Sokoto North Western Nigeria as well as Busch et al, Alamawi et al., in USA and Saudi Arabia respectively [25,27]. WHO recommends transfusion from voluntary non-remunerated blood donors as it is the safest among the three classes of donors. The goal of the WHO is for all countries to obtain all their blood supplies through unpaid voluntary donors [4,30].

The distribution of p24 antigen based on the religion, tribe, occupation and educational level of the study population showed that prevalence of p24 antigen positivity was higher among Muslim donors than Christian donors. Furthermore, all donors who tested positive for the antigen were from the Yoruba tribe which is similar to what Olowe et al observed at Osogbo, South Western Nigeria [20]. Yorubas are the predominant tribe in Ilorin and Osogbo and this may explain why findings from both studies are similar in that regard. The city of Ilorin is predominantly inhabited by Muslim Yoruba people. This most likely accounted for the higher prevalence of the antigen among Muslims who are of Yoruba extraction. Religion was not significantly associated with p24 antigen positivity in this study (P = 0.61)

The prevalence of p24 antigen was higher among the military group (33.3%), despite the fact that the antigen occurred more frequently among the unemployed. This finding is at variance with similar studies done around the country. Olowe et al in Osogbo observed that both cases of p24 antigen positivity in their study were from self-employed donors, though in comparison with other occupational groups in that study, this was not statistically significant [18], A similar study conducted in Sokoto and China reported a higher prevalence among farmers [25], Okocha et al., in another study conducted at Nnewi South Eastern Nigeria reported the highest prevalence of transfusion-transmissible HIV among students and traders and observed the lowest prevalence among unemployed donors [31]. The main reason for this observation among the Military group, may be due to the extremely small size of the subpopulation in this study. In addition, another possible contributory factor is that individuals belonging to this occupational group are more exposed to sexually transmitted infections, than the other occupational subpopulations studied [32]. However, p24 antigen positivity was not significantly associated with donors' occupation (P = 0.841).

The prevalence of p24 antigen positivity was higher among donors with primary education (18.8%), than those with either tertiary or secondary education. This finding was consistent with that of Song et al in China who observed a higher prevalence of transfusion-transmissible HIV infection among lower educated donors [32]. However, this finding is at variance with that of Olowe et al., who in a similar study done at Osogbo South Western Nigeria reported a higher prevalence among donors with a higher level of education [18]. The higher prevalence of p24 antigen positivity among donors with primary education observed in this study may be due to lack of adequate formal education, which may hamper the knowledge base of these donors on transmission of HIV and its preventive methods, especially when these information are presented in complex ways. p24 antigen positivity was not found among donors with no formal education. This has not been reported in any of the previous research conducted in the country or elsewhere. The

reason for this finding may be due to the extremely small size of this subpopulation in the sample population. Educational level of donors had no significant association with p24 antigen positivity in this study (P = 0.303) [33-40].

CONCLUSION

The prevalence of p24 antigen positivity was observed to be 6.7%. All p24 antigen positive donors in the study population were young, between 21-40 years, and were either family replacement or paid donors (with prevalence being higher among paid donors). No voluntary non-remunerated donor tested positive for p24 antigen.

It may be concluded from this study that blood transfusion still carries a significant amount of risk in Nigeria, especially when HIV donor screening is based exclusively on serological detection of HIV antibodies and blood supply still comes from commercial and family replacement donors.

RECOMMENDATIONS

1. All centers where blood transfusion services occur in the country must try as much as possible to adhere to strict donor selection criteria as recommended by WHO; and the country should be committed to implementing the National Blood Transfusion Policy.
2. Donation of blood from commercial donors must be abolished while donation from replacement donors discouraged. However, all efforts should be geared towards increasing voluntary non-remunerated blood donation.
3. Sustained Health education programmes aimed at increasing public awareness on the need to donate blood voluntarily and the benefits associated with it, should be put up by the government and all stakeholders. Also, Youths should be educated on high risk behaviours and lifestyles that can predispose them readily to contracting HIV infection.

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