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Seroprevalence and risk factors for human T cell lymphotropic viruses types 1 and 2 among blood donors in Jos, Nigeria

Ma'an V. T., Fasola F. A., Egesie O. J., Ma'an D. N.

ABSTRACT

Aims: To determine the seroprevalence and risk factors of human T cell Lymphotrophic viruses 1 and 2 among blood donors in Jos, Plateau state, Nigeria. Methods: A cross sectional study of 500 consecutive blood donors from the blood bank of Jos University Teaching Hospital and National Blood Transfusion Services Jos were recruited into the study. Questionnaires were administered and blood samples were collected from all participants. Sera of the blood donors were assayed for HTLV 1 and 2 using micro-enzyme–linked immunosorbent assay. Data was analysed using Epi Info version 3.5.1 and statistical significance was set at p-values ≤0.05. Results: The mean age of the study population was 29.9±8.9 years with a male - female ratio of 4.2:1. Voluntary blood donors constituted 50.6% while family replacement blood donors constituted 49.4%. The mean hemoglobin was 14.9±1.2 g/dl. Although 4% of the blood donors had different forms of exposure to risk factors, none was positive for HTLV-1 or HTLV-2. Conclusion: Human T cell lymphotrophic virus had zero seroprevalence among tested blood donors in Jos. However, continuous surveillance is necessary to keep the prevalence at low ebb. Further studies using larger sample size to include other healthy adults, commercial sex workers and pregnant women should be carried out in the entire country to define the prevalence of the virus in Nigeria.

Keywords: Blood donors, HTLV, Nigeria, Prevalence

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INTRODUCTION

Human T cell lymphotrophic virus (HTLV) is one of the viruses implicated in transfusion transmissible infection. The HTLV belongs to the retroviridae family of genus *Deltavirus*. It is an envelope virus, the only human pathogen of the subfamily Oncovirus, which

includes HTLV-1, and HTLV-2 [1]. Other new members are HTLV-3 and HTLV-4 [2]. The three major routes of HTLV transmission are blood transfusion [3, 4], sex [5] and mother to child infection via breast milk [6]. The virus can also be transmitted through intravenous drug abuse [7], human bite [8] and organ transplant [9]. The diseases associated with HTLV infection are adult T cell leukemia/lymphoma (ATLL), HTLV associated Myelopathy/Tropical spastic paraparesis (HAM/TSP), uveitis and infective dermatitis [10].

The HTLV was first detected and isolated in 1979 in the United States of America [11]. Since its discovery, it has been globally estimated that 15–20 million people have been infected with the virus worldwide [12]. The infection is endemic in regions of Sub-Saharan Africa, Japan, America, Melanesia, and Middle East [13]. A prevalence rate of 15% and 37% was reported in some selected populations in South-Western Japan in contrast to a low seroprevalence rate of 0.0039% among French blood donors [13, 14]. In Sub-Saharan African countries like Benin, Cameroun, and Guinea Bissau, a prevalence rate as high as 5% has been reported [15]. HTLV infection has not been studied extensively in Nigeria. The few studies carried out on blood donors were in some parts of South-West and Eastern Nigeria. The reported seroprevalences were between 0.7 and 4.8% [16–18]. There is a dearth of data on its seroprevalence in the Northern part of the country. Another study carried out by Forbi et al. in Ibadan, also in South Western Nigeria, in a population of highly sexually active groups and secondary school students a seroprevalence of 5.1%, 16.7%, and 22.9% in the secondary school students, pregnant women and commercial sex workers respectively was reported [19]. This suggests that women and commercial sex workers are the high risk groups. A prevalence rate of 7.4% was reported among injection drug users in King County, Washington [7]. Prevalent infection was associated with female gender, non-white race, longer duration as IDU, having a tattoo, combined injection of heroin and cocaine, and with serologic evidence of hepatitis B and C infection [7]. A population study in Iran with 2% prevalence showed that it was significantly associated with age, marital status and history of blood transfusion [20], while another study among blood donors indicated that low income, low educational level, history of blood transfusion and non-IV drug abuse were significant predictors for infection [21]. Analysis of risk factor in Dutch blood donors suggested country of birth and sexual risk factors as predictor of infection with HTLV [22]. A study showed that blood recipients at greatest risk for seroconversion were those who received multiple transfusions or received immunosuppressive therapy at the time of transfusion. In view of the aforementioned, these patients should be given priority in receiving selectively screened blood components, if routine blood-donor screening for HTLV-I is not possible [3].

In Nigeria, donated blood is screened for human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV) and *Syphilis* [23] while human T cell lymphotropic virus is not routinely screened for because the studies carried out so far are not sufficient to determine its cost-effectiveness with regard to the spread of the infection. Public health intervention measures aimed at preventing infected individuals from donating is important because, there is no treatment for HTLV infection and complications of the infection such as ATLL and HAM/TSP have no cure. These have socioeconomic implications for an infected individual, his/her family, the general public and health care system.

Another justification for determining the seroprevalence of HTLV in the blood donors is that fresh whole blood continues to be the major blood product available to treat a significant proportion of bleeding diathesis since many blood banks in Nigeria do not prepare cell blood product. Since the transmission of HTLV occurs through cellular components, the transfusion of unscreened blood product may increase the population infected with HTLV infection if present in the blood product. Therefore, this study aims to determine the contributory role of infected donated blood to the acquisition of HTLV infection in Jos, Nigeria. This study will also contribute to the body of information required for policy formulation to further improve blood safety in Nigeria.

MATERIALS AND METHODS

A cross sectional study was carried out among prospective blood donors at the blood bank of Jos University Teaching Hospital and National Blood Transfusion Services of Jos metropolis. Both facilities are located in Jos the capital of Plateau State, North Central geopolitical Zone of Nigeria. These centers serve States in this Zone. Consecutive consenting voluntary and family replacement blood donors were recruited over a three-month period (November 2013–January 2014). The minimum sample size was determined using Leslie and Kish formula for sample determination. The estimated sample size using a seroprevalence rate of 4.8% [18] was 390 but a sample size of 500 was used in this study. Participants were blood donors who passed the hemoglobin test to rule out anemia and answered the blood bank questionnaire for blood donor selection. The samples for HTLV assay were collected at the same time with samples for screening for other transfusion transmissible infections (TTIs) such as HIV, HBV, HCV and *Syphilis*.

Ethical approval was obtained from the ethical committee of Jos University Teaching Hospital Jos. Written informed consent was obtained from all participating blood donors. Relevant information on demographic data which include age, gender, occupation, educational and marital status and risk factors such as sexual activities, scarification, tattoo, intravenous drug abuse and history of blood transfusion were obtained from

the subjects with the aid of a standardized questionnaire which was filled by the researcher and a trained assistant.

Ten milliliters of venous blood was collected by venipuncture at the volar surface of the left arm while 3.5 ml of the collected blood sample was taken in a potassium ethylenediaminetetraacetic acid (EDTA) evacuated tube (BD vacutainer) for hemoglobin estimation, the remaining 6.5 ml of the venous blood was transferred into a new screw capped plastic tube without anticoagulant and allowed to clot at room temperature for 30 minutes. Each bottle was labeled with donor's unique identification number. The clotted samples were centrifuged and sera extracted and stored at -20°C until analysis.

The sera were screened for HTLV antibody using a commercially available ELISA kit (HTLV 1 and 2 ELISA kit, Lot number T20130702; Diagnostic Automation/ Cortze Diagnostic Inc. Calabasa, California 91302 USA). It is an antigen "sandwich" enzyme immunoassay method which uses polystyrene microwell strip precoated with recombinant HTLV antigen in *E. coli*. The samples were also analyzed in duplicates while the mean values were accepted. Analytical accuracy and precision were ensured by running samples alongside with their positive and negative controls.

The data obtained was analyzed using Epi info version 3.5.1 statistical package. Mean and standard deviation (SD) were determined to describe continuous variables and proportions for categorical data.

RESULTS

There were only two types of blood donors; - voluntary and family replacement blood donors as in Table 1. Majority of the blood donors were within the age range of 18–24 years and the least number of donors were within the range of 53–59 years. The mean age was 29.9 years ±8.9 years. There were more male donors than female donors, with male-female ratio of 4.2:1. Majority of the blood donors had tertiary education. More than half of the blood donors were married and 43.6% were students. The sociodemographic profile of the blood donors are as in Table 1.

All blood donors screened for HTLV 1 and 2 infections were seronegative. Of the 500 blood donors, 25 (4%) were identified to have different forms of exposure to the risk factors for the transmission of HTLV as summarized in Table 2. None of the blood donors has ever had blood transfusion.

DISCUSSION

The findings in this study showed that all 500 blood donor samples screened for HTLV 1 and 2 infections were negative giving a seroprevalence of 0.0%. The zero prevalence in this study could be explained by the high population of voluntary blood donors which is characteristic of the National Blood Transfusion Services. The high population of voluntary donors in this study results from the awareness programmes deployed through media publicity and visit to places of worship and schools. High educational level with greater than half of the blood donors having tertiary education might have also contributed to the low seroprevalence as indicators of lower socioeconomic status such as education has been associated with high seroprevalence rate. It is surprising that a zero seroprevalence was also observed even among the hospital based blood donors who were family replacement donors that have donated blood for sick friends and family members through compulsion [24, 25]. This might support the low seroprevalence already alluded to by previous studies in other regions of the country. A seroprevalence of 0.0% [26], 0.7% [17, 27] among voluntary blood donors were recorded at the University of Nigeria Teaching Hospital Enugu, Calabar and Lagos University Teaching Hospital respectively. The finding in this study is inconsistent with the middle seroprevalence of 1.4% [28], 3.6% [16] observed in Port Harcourt, Oshogbo respectively. Age and gender has been reported to contribute to differences in HTLV seropositivity [12]. The age and gender pattern of the blood donors in Oshogbo with a seroprevalence pattern of 3.6% and our study with a zero seroprevalence are similar. The middle seroprevalence in these studies were carried out among predominantly family replacement donors although interestingly the seropositivity for HTLV was observed in both family replacement and voluntary blood donors. However, the findings above suggest that the seroprevalence of HTLV in Nigeria vary from region to region. Interestingly previous studies carried out in Nigeria had identified infection in the study population though were of a smaller sample size compared to our study. The observation of low HTLV in relation to high recruitment of voluntary blood donors further supports the view of WHO for an organized blood transfusion services which is not hospital based [29].

The zero seroprevalence observed among our blood donors has been reported among voluntary blood donors in Kingdom of Saudi Arabia and Isfahan, Iran [30, 31]. In another study carried in Cotonou, Benin Republic, 1300 blood donors were screened, none was positive, but a prevalence of 0.3% and 5.4% was observed in coastal and Northern provinces respectively in the same country [29]. The high seroprevalence rate of >5% was observed in African countries like Benin, Cameroon, and Guinea Bissau [32] and 8.1% in Gabon [33]. This suggests a wide seroprevalence in Africa ranging from low to high prevalence. This might be one of the reasons sub-Saharan Africa is classified as an endemic region. In Brazil, the highest prevalence (1.35%) was described in the central and coastal areas with low prevalence (0.08%) in the Northern and Southern parts [34]. Also in a study carried out in Columbia, a prevalence of 4.3% was reported for low-altitude areas and 0.73% for high altitude areas [35]. These further support the observation

Table 1: Sociodemographic profile and type of blood donors

Socio-demographics	Frequencies	Percentages (%)
Age group		
18–24	163	32.6
25–31	159	31.8
32–38	96	19.2
39–45	47	9.4
46–52	27	5.4
53–59	8	1.6
Total	**500**	**100**
Sex		
Male	403	80.6
Female	97	19.4
Total	**500**	**100**
Educational status		
Non-formal education	53	10.6
Primary	22	4.4
Secondary	145	29.0
Tertiary	280	56.0
Total	**500**	**100**
Marital status		
Single	306	61.2
Married	190	38.0
Widowed	1	0.2
Divorced	3	0.6
Total	**500**	**100**
Occupation		
Business	96	19.2
Driver	6	1.2
Farmer	24	4.8
Public servant	101	20.2
Student	218	43.6
Teacher	3	0.6
Unemployed	49	9.8
Total	**500**	**100**
Donor type		
Voluntary donor	253	50.6
Family replacement	247	49.4
Total	**500**	**100**

Table 2: Frequencies of risk factors among blood donors

Risk factors	Yes n(%)	No n(%)	Total (%)
Previous Transfusion	0(0.0)	500(100)	500(100)
Intravenous drug use	2(0.4)	498(99.6)	500(100)
History of needle sharing	1(0.2)	499(99.8)	500(100)
Unprotected sex	8(1.6)	492(98.4)	500(100)
Multiple sexual partners	4(0.8)	496(99.2)	500(100)
Scarification marks	5(I.0)	495(99.0)	500(100)
Tattoo	5(1.0)	495(99.0)	500(100)

that the seroprevalence rate of HTLV infection can vary depending on the geographical location even in the same country as is the case in Nigeria.

High seroprevalence rate has been reported in isolated population groups such as observed in Italy where HTLV is sporadic and confined to immigrants

arriving from endemic areas [36]. Among the blood donors 4% were identified to have had risk factors for HTLV transmission but none of them were positive for HTLV 1 and 2 infections. The observation in this study is similar to that reported from Enugu, Eastern part of Nigeria and a study carried out by Agrawal et al. 2010 in West India where 534 blood samples (267 blood donors and 267 high risk behavior persons) were tested for HTLV 1 and 2 and none was positive [37]. In a study carried out in Jamaica, 44% of recipients of HTLV-1 positive cellular blood component seroconverted while none of the recipient of HTLV-1 positive non-cellular blood component seroconverted [3]. Risk factors for seroconversion in the blood recipient were receipt of a seropositive cellular blood component stored for less than one week, male gender and use of immunosuppressive therapy at time of transfusion [3]. A seroprevalence of 5.7% was recorded among active reproductive group in Jamaica which increased with age [5]. In Guinea Bissau, Mali, and Sudan it was observed that HTLV infection is associated with traditional scarification and in Sub-Saharan Africa, ornamental scarification was associated with a 3.3 fold increase risk [38, 39]. The blood donors in this study did not have a history of blood transfusion. Though they have risk factors for the infection, such as ornamental scarification unprotected sex with multiple sexual partners, intravenous drug use; they were seronegative. These individuals who were exposed to risk factors for the infection by the viruses are candidates for window period reservoir for HTLV and other transfusion transmitted viruses therefore should not be included in the blood donor pool irrespective of their screening status. The low prevalence among blood donors with risk factors in this study may suggest a low prevalence in the general population with whom they must have interacted with. A larger sample size might increase the probability of identifying positive individuals among those exposed to the risk factors of contracting these viruses.

CONCLUSION

The seroprevalence of HTLV is low among blood donors in Jos compared to studies carried out in other parts of Nigeria. The low prevalence might be a reflection of the seroprevalence in the general population where the donors were recruited. This study suggests that routine screening of blood donors may not be cost effective, however, there is a need for continuous monitoring of the seroprevalence rate to ensure blood safety.

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Author Contributions

Ma'an V. T. – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Fasola F. A. – Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

Egesie O. J. – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Ma'an D. N. – Analysis and interpretation of data, Revising it critically for important intellectual content, Final approval of the version to be published

Guarantor

The corresponding author is the guarantor of submission.

Conflict of Interest

Authors declare no conflict of interest.

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