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The Prevalence of Human T-Cell Lymphotropic Virus 1/2 Among Blood Donors in Owo, Ondo State, Nigeria: A Cross-Sectional Study

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Abstract

This study examines the sero-epidemiology of Human T-cell Lymphotropic Virus (HTLV) types 1 and 2 among blood donors in Owo, Ondo State, Nigeria, in the year 2024, focusing on prevalence, socio-demographic factors, and public health implications. Among 88 predominantly male donors (94.3%) aged 25–39 years (61.4%), the majority were Yoruba (86.4%) with secondary education (68.2%). Blood specimens were screened for HTLV using stringent kit from DIAPRO, Italy, with data analyzed via SPSS version 25. The study found a 3.4% HTLV-1/2 prevalence, higher than the West African regional average but lower than similar studies in Lagos. Socio-demographic factors, including age, gender, education, and occupation, showed no statistically significant correlation with infection. Similarly, HTLV prevalence was unaffected by blood group or donor type, although commercial donors dominated (71.6%), followed by relatives (23.9%) and voluntary donors (4.5%). Concerningly, only 3.4% of participants were aware of HTLV, with 87.5% mistakenly attributing transmission to mosquitoes and 86.4% associating its cause with supernatural factors. This highlights a critical need for targeted educational campaigns. The predominance of commercial donors raises further concerns about blood safety, as they are often linked to higher risks of transfusion-transmitted infections (TTIs). The findings emphasize the urgent need for routine HTLV screening in blood banks and strategies to increase voluntary, non-remunerated blood donation. Public education campaigns are essential to correct misconceptions and promote safer blood donation practices. This study underscores the importance of enhanced screening protocols, public education, and a shift towards voluntary blood donation to reduce transfusion risks and improve public health outcomes.

Keywords: Blood Safety; HTLV-1/2; Public Health Awareness; Transfusion-Transmitted Infections; Voluntary Blood Donation

1.0 Introduction

Human T-Cell Lymphotropic Virus (HTLV) types 1 and 2 remain among the most clinically significant retroviruses globally. These viruses are implicated in complex hematological and neurological disorders, with HTLV-1 associated with severe conditions such as adult T-cell leukemia/lymphoma (ATL) and HTLV-1-associated myelopathy/tropical spastic paraparesis (HAM/TSP) (Pacheco et al., 2021). Recent research has highlighted HTLV-2's potential neurological implications, expanding our understanding of its pathogenic spectrum (Iwanaga *et al.,* 2020).

HTLV infections present significant global public health challenges, characterized by prolonged asymptomatic periods and multiple transmission routes, including blood transfusion, sexual contact, breastfeeding, and needle sharing (Rodrigues *et al.,* 2022). The emergence of advanced molecular diagnostics has enhanced our ability to track and understand these transmission dynamics.

The global epidemiological landscape reveals varied HTLV prevalence, with endemic regions including southwestern Japan, parts of Africa, the Caribbean, and South America (Casseb *et al.,* 2021). Notably, recent studies have emphasized gender-specific transmission patterns, with women experiencing disproportionate infection rates due to complex biological and social factors (Barreto-Filho *et al.,* 2022).

HTLV-1 and HTLV-2 are retroviruses belonging to the Delta retrovirus genus, sharing approximately 70% genomic similarity while exhibiting distinct pathogenic characteristics (Silva *et al.,* 2020). Advanced molecular studies have revealed nuanced differences in cellular tropism and immune interactions between the 2 types. The HTLV-1 primarily targets CD4+ T-cells; while HTLV-2 predominantly infects CD8+ T-cells. Both viruses demonstrate remarkable genome integration capabilities

The viruses' prolonged latency period remains a critical research focus, with emerging studies exploring the complex mechanisms of viral persistence and potential immune evasion strategies (Leung *et al.,* 2021).

Recent molecular research has provided deeper insights into HTLV's pathogenic mechanisms. The viral proteins Tax and Rex continue to be crucial in understanding cellular transformation processes. Tax protein acts as a transcriptional activator influencing T-cell proliferation; Rex protein facilitates efficient viral RNA expression; while emerging evidence suggests epigenetic modifications play a significant role in viral persistence (Mahajan *et al.,* 2022).

Sub-Saharan Africa remains particularly vulnerable, where underdeveloped blood donation systems and limited voluntary non-remunerated blood donation infrastructure exacerbate transfusion-transmissible infection (TTI) risks (Adebayo *et al.,* 2021). This study aims to investigate the sero-epidemiology of HTLV-1 and HTLV-2 among blood donors in Owo, Ondo State, Nigeria, with a focus on contemporary epidemiological insights and public health interventions. There was no previous study documented on the prevalence of HTLV-1 and 2 among donors certified fit for donation in Owo.

1.1 Global Distribution and Epidemiology

Contemporary epidemiological research has refined our understanding of HTLV distribution. Key observations include persistent endemicity in southwestern Japan, Caribbean, and parts of Central and South America; increasing recognition of migration's role in viral spread and complex interactions between cultural practices and transmission dynamics (Satake *et al.,* 2022)

1.2 Socio-Demographic and Cultural Determinants

Recent studies have emphasized the intricate relationship between socio-demographic factors and HTLV transmission. The factors implicated include age and gender which were established as critical risk factors.

Educational interventions show promise in reducing transmission, while cultural misconceptions continue to challenge prevention efforts (Oliveira *et al.,* 2023)

1.3 Blood Donation Practices in Nigeria

The landscape of blood donation in Nigeria continues to evolve, with persistent challenges. Although, there are less than 5% of donations from voluntary non-remunerated source, efforts are ongoing to improve screening and recruitment strategies (Ekwere *et al.,* 2022).

1.4 HTLV Screening and Diagnostic Challenges

Diagnostic approaches have advanced significantly. These include integration of molecular techniques alongside traditional serological methods, development of more sensitive screening protocols and increased focus on early detection strategies (Taylor *et al.,* 2023).

1.5 Public Health Education and Awareness

Contemporary approaches emphasize culturally sensitive educational interventions, targeted awareness campaigns and interdisciplinary collaboration in knowledge dissemination (Rosadas *et al.,* 2022)

1.6 Research and Vaccine Development

Promising research directions include advanced molecular engineering techniques, exploration of immunotherapeutic approaches and increased understanding of viral latency mechanisms (Bangham *et al.,* 2020)

2.0 Methodology

The researchers maintained rigorous ethical standards by obtaining approval from the Ethics Committee at Federal Medical Centre, Owo and informed consent from every participant. A cross-sectional study was carried out on 88 blood donors who were selected by random sampling technique. Venous blood samples collected aseptically into plain tube was centrifuged and serum harvested was used to carry out ELISA screening for HTLV 1 & 2 immunoglobulins, using stringent ELISA kit from DIAPRO, Italy. The results were interpreted in adherence to manufacture's instruction; while data generated were analysed with ASPSS version 23 to generate relevant proportions which were subjected to chi square test at 95% confidence interval ($p<0.05$).

3.0 Results

Table 1a and b depict the socio – demographic variables including age, gender, tribe, educational status and occupation of blood donors in Owo. Most of the blood donors were males reflecting 83 0f them (94.3%) and females were only 5 0f them (5.7%)

Table 1a: Socio-demographic variables of blood donors in Owo

Variables	Category	Frequency	Percentage
Age Group	15-19yrs	2	2.3
	20-24yrs	14	15.9
	25-29yrs	18	20.5
	30-34yrs	20	22.7
	35-39yrs	16	18.2
	40-44yrs	10	11.4
	45-49yrs	5	5.7
	50-54yrs	3	3.4
Gender	Male	83	94.3
	Female	5	5.7
Tribe	Yoruba	76	86.4
	Igbo	6	6.8
	Hausa	3	3.4
	Ebira	3	3.4
Educational Status	Nil	5	5.7
	Pry	16	18.2
	Sec	60	68.2
	Tertiary	7	8.0
Occupation	Barbing	14	15.9
	Schooling	22	25.0
	Farming	10	11.4
	Okada Ridding	5	5.7
	Civil Servant	7	8.0
	Trading	18	20.5
	Tailoring	12	13.6
	Total	88	100.0

Table 1b: Expressive Figures

	Number	Least	Maximum	Mean	Std. Deviation
Age	88	19	55	32.77	8.257

Table 2 depicts the HTLV and blood donation awareness showcasing some variables including awareness, cause, route, Adult T cell Lymphoma and previous donation among blood donors in Owo. Most of the blood donors were not aware of the virus reflecting 85 of them (96.6%) and only three of them have the awareness (3.4%). 59 0f them had donated before (67%) while 29 of them had no previous donation experience (33%).

Table 3 depicts the ABO and Rh blood groups of participants with six categories. Most of them are O positive reflecting 51 of them (58%) and AB positive being the least, only 1(1.1%).

Table 2: HTLV and Blood Donation Awareness in Owo

Variables	Category	Frequency	Percentage
Awareness	**Yes**	3	3.4
	No	85	96.6
Cause	**Infection**	12	13.6
	Evil spirit	76	86.4
Route	**Body fluids**	11	12.5
	Mosquitoes	77	87.5
Adult T Cell Lymphoma	**Cancer by HTLV**	10	11.4
	Idiopathic	78	88.6
Previous Donation	**Yes**	59	67.0
	No	29	33.0
	Total	88	100.0

Table 3: Blood Group of Participants

Category	Frequency	Percentage
O positive	51	58.0
O negative	8	9.1
A positive	11	12.5
A negative	2	2.3
B negative	15	17.0
AB positive	1	1.1
Total	88	100.0

Table 4 depicts blood donor types of participants with three categories: commercial, voluntary and relative. Most of the blood donors were commercial reflecting 63 of them (71.6%), 21 0f them were relatives (23.9%) and only 4 of them were voluntary donors (4.5%).

Table 5 depicts the occurrence of HTLV amongst blood donors in Owo with the two categories: positive and negative. 3 of the blood donors were reactive to the virus (3.4%) which is high, because human lives are being considered.

Table 6 depicts the outcome of socio – demographic and awareness variables on HTLV status which include age group. Gender, education, awareness, knowledge about cause, awareness about ATL cause and previous donation. When relating the degree of freedom with all the p=values, it was discovered that the effect of all the variables was not significant on the HTLV status because all the p values were higher than 0.05.

Table 7 depicts the effect of education on knowledge and awareness parameters which include awareness about HTLV, knowledge about HTLV transmission, information about route and ATL awareness. All the p values were lesser than 0.05 which made them significant.

Table 4: Blood Donor Types of Participants

Category	Frequency	Percentage
Commercial	63	71.6
Voluntary	4	4.5
Relative	21	23.9
Total	88	100.0

Table 5: Occurrence of HTLV among Blood Donors in Owo

Category	Frequency	Percentage
Positive	3	3.4
Negative	85	96.6
Total	88	100.0

Table 6: Effect of Socio-demographic and Awareness variables on HTLV Status

Variables	Df	P-value	Remark
Age group	7	0.872	NS
Gender	1	0.837	NS
Education	3	0.845	NS
Occupation	6	0.705	NS
Awareness	1	0.741	NS
Knowledge about Cause	1	0.505	NS
Awareness about ATL Cause	1	0.528	NS
Previous Donation	1	0.217	NS

NS: Not SignificantTable 7: Effect of Education on Knowledge and Awareness Parameters

Variables	Degree of freedom Df	P=value	Remark
Awareness about HTLV	3	0.000	S
Knowledge about HTLV Transmission	3	0.000	S
Information about Route	3	0.000	S
ATL Awareness	3	0.000	S

S: Significant

4.0 Discussion

This research investigated the sero epidemiology of Human T-cell Lymphotropic Virus 1\2 (HTLV 1\2) among blood donors in Owo, revealing several significant findings that warrant careful consideration in the setting of blood security and public health.

4.1 Sero epidemiology of HTLV-1/2 among Blood Donors in Owo

This study observed a 3.4% prevalence rate of HTLV-1/2 among blood donors in Owo, Ondo state, Nigeria. This rate indicates a relatively high and significant presence of the virus in the donor population, highlighting the need for targeted screening measures. Worthy of note is that three among the donors tested positive (3.4%), suggesting that while the overall risk may be high, the presence of HTLV-1/2 should be given due consideration

for its potential impact on health, including the risk of adult T-cell leukemia/lymphoma (ATL). This finding of 3.4% is particularly important when compared to recent studies: it is higher than the 1.2% reported in a 2023 systematic review of HTLV prevalence in West Africa (Rahman et al., 2023), but lower than the 5.1% reported in a similar Nigerian study conducted in Lagos (Ogundeji et al., 2024). The presence of HTLV in the blood donor population even at relatively low levels, presents a significant public health concern considering the serious complications associated with HTLV infection.

4.2 Correlation with socio - demographic characteristics

Analysis of socio - demographic factors (age, gender, education, and occupation) showed no significant correlation with HTLV status, as evidenced by p-values greater than 0.05 for all variables tested. Despite this, the demographic profile indicates that the highest among blood donors were young males, predominantly of Yoruba ethnicity, with secondary education.

4.3 Several demographic factors from the study population

Gender Distribution: The stark gender disparity among blood donors (94.3% males against 5.7% females) aligns with recent findings from other West African studies showing male predominance in blood donation (Adewuyi et al., 2020). This gender imbalance may affect the representativeness of HTLV prevalence data for the general population.

Age Distribution: The majority of donors (61.4%) were between 25-39 years old, with peak representation in the 30-34 age group (22.7%). This age distribution is optimal for blood donation but may influence HTLV prevalence rates, as recent research suggests age-dependent variations in HTLV infection rates (Thompson et al., 2022).

Educational Status: A significant proportion (68.2%) had secondary education, while only 8% had tertiary education. Recent studies have shown correlations between educational level and blood donation awareness (Kumar et al., 2023), which may impact donation practices and risk behaviors.

4.4 Influence of donation type and blood group on HTLV infection

The majority of donations came from commercial donors (71.6%), followed by relative donations (23.9%), with voluntary donors making up a small fraction (4.5%). The high percentage of commercial donors might reflect economic drivers rather than altruism, potentially increasing the risk of HTLV and other infections due to less stringent donor selection. However, there was no statistical evidence linking the type of donation to HTLV status ($p > 0.05$). Regarding blood groups, the most common was O positive (58%), but the distribution of HTLV infection across blood groups did not show any significant association.

4.5 Blood donation patterns and safety implications

An important finding is the high proportion of commercial donors (71.6%) compared to voluntary donors (4.5%). This distribution pattern raises several safety concerns. Recent research indicates that commercial donors may have higher rates of blood borne infections due to potentially risky behaviors (Chen et al., 2024). The low percentage of voluntary donors (4.5%) falls significantly below the WHO's recommended target of 100% voluntary non-paid blood donation.

The study revealed critical gaps in HTLV awareness; only 3.4% of donors were aware of HTLV, indicating a severe knowledge deficit. Misconceptions about transmission routes were prevalent, with 87.5% incorrectly believing mosquitoes transmit HTLV. The high attribution of HTLV to evil spirits (86.4%) suggests deeply rooted cultural beliefs that may impact health-seeking behaviors and prevention strategies.

4.6 Public health implications

These findings have several important implications for public health practice. The need for enhanced HTLV screening protocols in blood banks, particularly given the high proportion of commercial donors, the importance of developing targeted educational interventions to address misconceptions about HTLV transmission and causation and the necessity of strategies to increase voluntary blood donation and reduce dependence on commercial donors.

5.0 Limitations

The data generated is limited by the small sample size of 88, with majority of the donors being male. Also, lack of confirmatory testing for HTLV-positive samples could affect prevalence accuracy.

6.0 Conclusion

This study provides a comprehensive assessment of HTLV-1/2 sero epidemiology among blood donors in Owo, revealing a significant presence (3.4%). This research indicates that there is no significant correlation between HTLV-1/2 infection and socio-demographic characteristics. The type of blood donation (commercial, relative, voluntary) and blood group do not appear to significantly influence the prevalence of HTLV-1/2. Despite low awareness levels among donors, the detection of HTLV in the donor pool suggest s the virus may be underreported or misdiagnosed, necessitating more robust educational and screening programs.

7.0 Recommendations

It is recommended that routine HTLV screening be included as part of the standard screening protocol for entirely blood donations in Owo, Ondo state, Nigeria. This would help decrease the danger of transfusion-transmitted infections (TTIs) including HTLV 1\2 and advance blood security. The study also highlighted a significant gap in awareness regarding HTLV-1/2 and its transmission. Education initiatives targeting potential blood donors should be intensified, focusing on the risks related with HTLV and importance of safe blood donation practices. The high proportion of commercial donors increases concerns about the possibility for higher infection rates. Encouraging voluntary, non-remunerated donations could help advance the excellence of the donor pool and decrease the risk of TTIs. Campaigns promoting voluntary donations, alongside stricter eligibility criteria, may enhance overall blood safety. Given the lack of significant correlations with socio – demographic variables, future studies should investigate other potential danger features for HTLV infection, like sexual behavior, history of intravenous drug use, or previous transfusions. A broader epidemiological study could help identify underlying patterns and inform more effective public health interventions.

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