



Seroprevalence of Human Immunodeficiency Virus (HIV) among Blood Donors Attending National Blood Transfusion and Research Center in Sana'a City, Yemen: Warning Sign

Tawfique K. Al-Zubiery¹, Hafez Alsumairy², Talal Alharazi^{2*}, Adel Al-Zubeiry³, Amar A. Jabir⁴, Majedi A. saleh⁵ and Manal J. Muckbil⁵

¹Department of Medical Laboratory, Faculty of Allied and Medical Sciences, Taiz University, Al-Turbah Branch, Yemen.

²Department of Clinical Microbiology and Immunology, Faculty of Medicine and Health Sciences, Taiz University, Yemen.

³Department of Medical Oncology, King Fahd Specialist Hospital, Dammam, Kingdom of Saudi Arabia.

⁴Department of Microbiology, National Blood Transfusion and Research Center, Yemen.

⁵Department of Medical Laboratory, National Blood Transfusion and Research Center, Yemen.

Authors' contributions

This work was carried out in collaboration between all authors. Author TKAZ designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author TA managed the analyses of the study. Author HA managed the literature searches. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/ISRR/2018/39984

Editor(s):

(1) Kailash Gupta, Division of AIDS, NIAID, NIH, USA.

Reviewers:

(1) Taremwa Ivan Mugisha, Institute of Allied Health Sciences, International Health Sciences University, Uganda.

(2) Oti Baba Victor, Nasarawa State University, Nigeria.

Complete Peer review History: <http://www.sciencedomain.org/review-history/23350>

Original Research Article

Received 27th November 2017
Accepted 23rd February 2018
Published 26th February 2018

ABSTRACT

Aim: To determine the seroprevalence of HIV among blood donors in Sana'a city: Yemen.

Study Design: A descriptive cross-sectional study.

Place and Duration of Study: The study was conducted at the National Blood Transfusion and Research Center in Sana'a City, Yemen; during the period from October 2016 to January 2017.

*Corresponding author: Email: alhrzali@yahoo.com;

Methodology: We included 3606 subjects (99.2% men, 0.8% women; age range 16-45 years) who enrolled in this study. The estimation of the prevalence of anti-HIV antibody was done using enzyme immunoassay (EIA) technique. Testing of blood donors specimens was performed at the laboratory virology unit.

Results: Out of 3606 blood donors who enrolled in this study, 0.6% donors were found to be reactive for the anti-HIV antibody, 82.0% of them were among blood donors residing in Sanaá Capital city. The prevalence rate of HIV was higher among students (0.9%), followed by military (0.8%), professional workers (0.6%), and handicrafts (0.4%). Half (50%) of HIV seropositive was detected among the age group 26-35 years old with prevalence rate 0.7%, followed by 16-25 and 36-45 years old with an account 0.6% and 0.5% respectively. There was no statistically significant difference ($p > 0.05$).

Conclusion: A substantial percentage of HIV seroprevalence was detected among our Yemenis blood donors. A strict selection of blood donors with the concern on getting voluntary donations is necessary.

Keywords: Blood donors; EIA; HIV; Sana'a; Yemen.

1. INTRODUCTION

Increase demanding for blood transfusion facilities may be due to multifactorial causes of anemia such as infection, malnutrition, and traumas associated with acute blood loss [1,2]. Blood transfusions can save the life and recover the health, but it also increases the risk of blood-borne infections to the recipients [3]. However, many of the patients do not have opportunities access to achieve safe blood transfusions, and every person must have equal access to safe blood [3].

A numerous of agents can possibly be transmitted through blood transfusions, comprising bacteria, viruses, and parasites. The presence of the following agents; Human Immunodeficiency Virus (HIV), Hepatitis B Virus (HBV), Hepatitis C Virus (HCV) and *Treponema pallidum* in all donated blood were routinely screened according to the recommended and adopted strategy by WHO in blood safety [4]. Another newly discovered agents like a transfusion-transmitted virus (TTV), SENV (SEN virus), Human herpesvirus-8 (HHV-8), Hepatitis G Virus (HGV), West Nile Virus and Prions present an emerging encounters in evaluating the potential risk they may carriage to the safety of blood and its products [5,6].

HIV is a lentivirus (a subgroup of retrovirus), the causative agent of acquired immunodeficiency syndrome (AIDS), has been one of the most serious health and developmental challenges worldwide of transfusion-transmitted infections [7,8]. The hazard of HIV transfusion through infected blood exceeds that of any other risk exposure. For that reason, it is necessary to

detect these blood-borne infections [9]. Continuous perfection in donor enrolment practices, donor education, donor screening, and blood analysis has ensued in constant decreases in the risk of transfusion transmission of HIV [9].

A series of blood screenings are implemented to test HIV. Serological tests can detect seroconversion within two to three weeks of infection in the majority of cases [10]. EIA is one of the most robust approved methods of high sensitivity and specificity. It is most commonly used as a screening test of HIV-1/2 and/or HIV p24 in serum or plasma [11]. Several methods, are essential to confirm positive antibody screens, such as Western blot, polymerase chain reaction [PCR] which deliver an assistant to antibody testing (p24 antigen, PCR), or offer additional evidence for the physician treating HIV patients (qualitative and quantitative PCR, and genotyping) which help to define the initiation of drug therapy and monitor the efficiency of treatment [10]. However, those techniques are too expensive and required highly skilled personnel [12,13].

The aim of our study was to determine the seroprevalence of HIV among Yemeni blood donors attending National Blood Transfusion and Research Centre in Sana'a. Detection of seroprevalence of HIV is required by the decision maker to knowing the precise circumstances of the virus in our community.

2. MATERIALS AND METHODS

2.1 Study Area

National Blood Transfusion and Research Centre in Sana'a Yemen, Testing of blood donors

specimens was performed at the laboratory virology unit.

2.2 Study Period and Population Size

This study was conducted from October 2016 to January 2017. During this period, 3606 blood donors consecutively were tested for anti-HIV antibody by the EIA method.

2.3 Ethical Issues and Data Collection

Permission to conduct the study was granted from the administration of National Blood Transfusion and Research Centre. Informed consents were obtained from all participants preceding to blood donation. A structured self-administered questionnaire was used to collect data [14]. A trained public health specialist for illiterate individuals filled the questionnaire through a face-to-face interview. The questionnaire gathered some of the socio-demographic characteristics of blood donors such as types of a donor, age, gender, residency, and occupation. Then, the collected information was treated confidentially.

2.4 Inclusion and Exclusion Criteria

As a general rule, all the individuals coming for blood donations were examined for blood pressure, pulse, hemoglobin content, and other general health checkups were done. Apparently, healthy persons of age 18 to 60 years with body weight above 45 kg would meet the requirements of donations and were included in this study. The only excluded criteria include those donors who did not satisfy the universal criteria for blood donation.

2.5 Sample Collection and Processing

All the blood donors, donating blood in the blood bank were considered as the study population. Five milliliters of blood was collected by the standard aseptic technique from each study person by trained laboratory technicians with the help of 5 ml disposable syringe and was transferred to a sterile test tube according to standard operation procedures (SOPs) [15].

2.6 Laboratory Assay

The blood was allowed to clot and after centrifugation, all serum specimens were analyzed for anti-HIV antibody by an EIA technique (Genscreen™ Ultra HIV Ag-Ab no.

72386; BioRad Diagnostics, 92430 Marnes-la-Coquette, France). This technique has an enzyme immunoassay based on the principle of the sandwich technique for the detection of HIV antigen and of the various antibodies associated with HIV-1 and/or HIV-2 virus in human serum or plasma with 100% sensitivity and specificity of 99.75% and was done according to manufacturer instructions [12,13].

2.7 Study Variable

The dependent variable of this study was anti-HIV antibody whereas the independent variables were donation type, sex, age, residencies, and occupation.

2.8 Statistical Analysis

The prevalence of anti-HIV antibody was determined from the proposition of seropositive individuals in the total donor population studied and was expressed as a percentage. Descriptive statistics of variable and other characteristics of sampled population were calculated and tabulated. A *p*-value less than 0.05 was considered statistically significant. The statistical difference was also evaluated by applying the Chi-square test. All the statistical analysis was done using the Statistical Package for Social Sciences (SPSS) software package version 20. (SPSS Inc. Chicago, Illinois, USAT).

3. RESULTS AND DISCUSSION

Out of 3606 blood donors who enrolled in this study, the males were 99.2%, whereas only 0.8% were females with the mean of age 29.95 years (range between 16 to 45 year). The result of this study showed that 22 donors were found to be reactive for the anti-HIV antibody, giving a total seropositivity of 0.6% and all of them were males. Replacement donors were 72.6% compared to 27.4% were voluntary donors. There is no statistically significant difference between anti-HIV seropositivity and the type of donors.

The majority of HIV reactive cases were among blood donors resident the Sana'a capital city with a prevalence rate of 0.8%. However, different prevalence rates of 0.2%, 0.6%, 1.2% and 2.7% were detected in Sana'a rural area, Ibb, Amran and Raymah governorates respectively. There is no statistically significant difference between anti-HIV seropositivity and the residency (Table 1).

In another hand the rate of anti-HIV antibody was higher among students with an account 0.9%, followed by military 0.8%, professional workers 0.6%, and handicrafts 0.4%, the difference in the result of anti-HIV antibody seropositivity among all of these blood donors groups was found to be statistically insignificant.

Furthermore, it was found that 50% of HIV seropositivity were detected among the age group 26-35 years old with prevalence rate 0.7%, followed by 16-25 and 36-45 years old with an account 0.6% and 0.5% respectively. There is no statistically significant difference between anti-HIV seropositivity and the age group.

The majority (72.6%) of blood donors at the place of this study were of replacement donors, a low percentage (27.4%) of voluntary donors (29.4%), which is consistent with observations in numerous other studies [4,6,14,16,17]. This indicates the need for many activities from

provincial health office to accomplish 100% voluntary donors who have been described to be the safest group of blood donors [14].

The result of the recent study revealed a slightly higher prevalence of anti-HIV antibody (0.6%) compared to a similar study conducted previously at 2012 by Sultan et al. [18] in Sana'a city the capital of Yemen who reported that 0.39% of blood donors were HIV positive. On the other hand, our result was much higher than that of other published two studies in China (0.08%) which carried out at five Chinese regional centers during the period of 2000-2016 [19,20] or that done in Pakistan (0.04%) by Arshad et al. [14]. While our finding approximately has equivalence with that reported by Bazie et al. [21], in his study in Sudan, who showed that, the Seroprevalence for antibodies against HIV was positive in 0.7% among Sudanese blood donors. However it was much lower than that reported in Kyrgyzstan at 2017 by Karabaev et al. [11] 3.3%, or that documented in Tanzania by Matee et al. [16]

Table 1. Seroprevalence of HIV among blood donors attending National Blood Transfusion and Research Center in Sana'a city with respect to types of donor, gender, residency, occupational and age groups

Donor category	Anti-HIV antibody				Total 3606(100.0%)		X ²	P
	Positive 22(0.6%)		Negative 3549 (99.4%)		No	%		
	No	%	No	%				
Voluntary	6	0.6	991	99.4	987	27.4	0.000	0.992
Replacement	16	0.6	2603	99.4	2619	72.6		
Gender								
Male	22	0.6	3556	99.4	3578	99.2	0.2	0.877
Female	0	0.0	28	100.0	28	0.8		
Residency(governorate)								
Sana'a Capital city	18	0.8	2301	99.2	2319	64.31	8.6	0.125
Sana'a rural area	1	0.2	580	99.8	582	16.14		
Ibb	1	0.6	171	99.4	171	4.74		
Amran	1	1.2	81	98.8	82	2.27		
Raymah	1	2.7	36	97.3	37	1.02		
Others	0	0.0	415	100.0	415	11.51		
Occupation								
Students	6	0.9	668	99.1	674	18.7	2.4	0.486
Professional workers	6	0.6	945	99.4	951	26.4		
Handicrafts	5	0.4	1337	99.6	1342	37.2		
Military	5	0.8	634	99.2	639	17.7		
Age groups								
16-25	8	0.6	1229	99.4	1237	34.3	1.2	0.876
26-35	11	0.7	1590	99.3	1601	44.4		
36-45	3	0.5	628	99.5	631	17.5		
46-55	0	0.0	121	100.0	121	3.4		
> 55	0	0.0	16	100.0	16	0.4		

X²: Chi-square, N: number; P: probability. (X² ≥ 3.84, P < 0.05: significant). No: number, %: percentage

3.8%, or that published by Ymele et al. [22] 4.44% in Cameroon during 2012 or that reported in Guinea by Xie et al. [23] 7.83%. The higher prevalence in our case may be due to the difference in the healthcare awareness system and the study periods. In Egypt, Shaimaa Snosy [24] reported lower rate in addition to another study in Nigeria by Aleruchi et al. [17] who reported that the prevalence of anti-HIV antibody was 0.1% and 0.45% respectively.

The high Seroprevalence of anti-HIV antibody in Yemeni blood donors suggests additional community established researches to recognize the main risk factor exposing Yemeni people for blood-borne HIV infections and to improve particular interferences to prevent transmission. On the other hand, one of the boundaries in our study is that positivity of anti-HIV antibody could not be further validated by a confirmatory assay.

In this study, Seroprevalence of HIV was higher amongst male donors in relation to female donors. The results may be due to the lower number of the donating females or due to menstruation cycle among female; therefore, less (0.8%) females were participated compared to males (99.2%). Many studies documented the same observation. Moreover, many efforts must be done to encourage and expand the number of female donors [4,6,17,24,25].

High Seroprevalence rate of HIV among student in this study as compared to other occupational groups, this could be related to reasons explained by Badahdah and Sayem [26] who found that university Yemeni students had numerous severe confusions about HIV/AIDS and detained bad attitudes to people living with HIV/AIDS. Even though female students were less familiar with HIV/AIDS than were male students, but they detained more encouraging attitudes to people with HIV/AIDS.

The present study showed that 86.4% of the total HIV seropositivity were detected among the age group 16-45 years old, of this 50% of HIV seropositivity were detected among 26-35 and 36.4% among the age group 26-35 years old. This could be due to a high sexual activity of this age group and a lot of consciousness formation action aiming that age group is required. Michel et al. at 2015 in his study in Lubumbashi, reported a similar result [27] who found that 9/10 (90%) of HIV among the age group 19-45 years old. This finding is the same as that made by other authors in African studies [6,17,17,19].

4. CONCLUSION

Our study shows a high seroprevalence of HIV among Yemenis blood donors was high, poor female's contribution and a low percentage of voluntary donors. Presented data were documented during the civil war in Yemen, which may lead to disruption of health care services and increase blood donor's demands due to the current conflict, may have worsened the problem of HIV infection in our community.

5. RECOMMENDATION

More study that is comprehensive is required. It is also necessary to increase the opportunity for NAT to confirm the results of serology and to improve blood resources safety during the serological window period.

CONSENT

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

ACKNOWLEDGEMENTS

We would like to acknowledge the participation of staff members of the National Blood Transfusion and Research Centre in Sana'a Yemen.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Ince C. Blood transfusions correct anemia and improve tissue oxygenation in surgical and critically ill patients. *Turk J Anaesthesiol Reanim.* 2017;45:119–121.
2. Al-Zubiery T, Alharazi T, Alsumairy H, Al-Zubiery A. Seroprevalence of HBs Ag, HCV and HIV among blood donors in three blood bank centers in Sana'a city: Yemen. *JBBS.* 2017;1:46–52.
3. Beltrami EM, Williams IT, Shapiro CN, Chamberland ME. Risk and management

- of blood-borne infections in health care workers. *Clin Microbiol Rev.* 2000;13:385–407.
4. Pagaro PM, Pandit DP, Patel AR, Chaudhari U, Others. Seroprevalence of human immunodeficiency virus in voluntary blood donors: Declining trend. *Med J DY Patil Univ.* 2013;6:236.
 5. Kaur P, Basu S, Others. Transfusion-transmitted infections: Existing and emerging pathogens. *J Postgrad Med.* 2005;51:146.
 6. Mohammed Y, Bekele A. Seroprevalence of transfusion-transmitted infection among blood donors at Jijiga blood bank, Eastern Ethiopia: Retrospective 4 years study. *BMC Res Notes.* 2016;9:129.
 7. Stramer SL, Glynn SA, Kleinman SH, Strong DM, Caglioti S, Wright DJ, Dodd RY, Busch MP. Detection of HIV-1 and HCV infections among antibody-negative blood donors by nucleic acid-amplification testing. *N Engl J Med.* 2004;351:760–8.
 8. Schneider WH, Drucker E. Blood transfusions in the early years of AIDS in sub-Saharan Africa. *Am J Public Health.* 2006;96:984–94.
 9. Donegan E, Lee H, Operskalski EA, Shaw GM, Kleinman SH, Busch MP, Stevens CE, Schiff ER, Nowicki MJ, Hollingsworth CG. Transfusion transmission of retroviruses: Human T-lymphotropic virus types I and II compared with human immunodeficiency virus type 1. *Transfusion.* 1994;34:478–83.
 10. Fearon M. The laboratory diagnosis of HIV infections. *Can J Infect Dis Med Microbiol.* 2005;16:26–30.
 11. Karabaev BB, Beisheeva NJ, Satybaldieva AB, Ismailova AD, Pessler F, Akmatov MK. Seroprevalence of hepatitis B, hepatitis C, human immunodeficiency virus, *Treponema pallidum*, and co-infections among blood donors in Kyrgyzstan: A retrospective analysis (2013-2015). *Infect Dis Poverty.* 2017;6:45.
 12. Makroo RN, Chowdhry M, Bhatia A, Arora B, Rosamma NL. Prevalence of HIV among blood donors in a tertiary care centre of north India. *Indian J Med Res.* 2011;134:950–3.
 13. Rerambiah LK, Rerambiah LE, Bengone C, Djoba Siawaya JF. The risk of transfusion-transmitted viral infections at the Gabonese National Blood Transfusion Centre. *Blood Transfus.* 2014;12:330–3.
 14. Arshad A, Borhany M, Anwar N, Naseer I, Ansari R, Boota S, Fatima N, Zaidi M, Shamsi T. Prevalence of transfusion transmissible infections in blood donors of Pakistan. *BMC Hematology.* 2016;16:27.
 15. Organization WH, Others. WHO guidelines on drawing blood: best practices in phlebotomy; 2016. Available:http://www.who.int/infection-prevention/tools/injections/drawing_blood_best/en/
 16. Matee MIN, Magesa PM, Lyamuya EF. Seroprevalence of human immunodeficiency virus, hepatitis B and C viruses and syphilis infections among blood donors at the Muhimbili National Hospital in Dar es Salaam, Tanzania. *BMC Public Health.* 2006;6:21.
 17. Aleruchi OPNF, Ezekoye CC. Seroprevalence of HIV infection among blood donors at the university of Port Harcourt teaching hospital, Rivers State, Nigeria. *GJBAHS.* 2014;3(2):1-7.
 18. Saghir SA, Omar S, Zabad FM. HIV and Syphilis among blood donors in Sana'a, Yemen. *Biohealth Sci Bull.* 2012;4:24–27.
 19. Li C, Xiao X, Yin H, He M, Li J, Dai Y, Fu Y, Ge J, Yang Y, Luan Y, Lin C, Zhao H, Li W. Prevalence and prevalence trends of transfusion transmissible infections among blood donors at four Chinese regional blood centers between 2000 and 2010. *J Transl Med.* 2012;10:176.
 20. Yang S, Jiao D, Liu C, Lv M, Li S, Chen Z, Deng Y, Zhao Y, Li J. Seroprevalence of human immunodeficiency virus, hepatitis B and C viruses, and *Treponema pallidum* infections among blood donors at Shiyuan, Central China. *BMC Infect Dis.* 2016;16:531.
 21. Bazie EA, Ali M, Hamza HB, Magzoub OS, Salih MSM, Haroun BE. Seroprevalence of viral transfusion-transmissible infections among blood donors at Kosti Teaching Hospital, White Nile State/Sudan. *Int J Curr Microbiol App Sci.* 2015;4:1132–1138.
 22. Fouelifack Ymele F, Keugoung B, Fouedjio JH, Kouam N, Mendibi S, Dongtsa Mabou J. High rates of hepatitis B and C and HIV infections among blood donors in Cameroon: A proposed blood screening algorithm for blood donors in resource-limited settings. *J Blood Transfus.* 2012;458372.
 23. Xie DD, Li J, Chen JT, Eyi UM, Matesa RA, Obono MMO, Ehapo CS, Yang LY,

- Yang H, Yang HT, Lin M. Seroprevalence of human immunodeficiency virus, hepatitis B virus, hepatitis C virus, and *Treponema pallidum* infections among blood donors on Bioko Island, Equatorial Guinea. PLoS ONE. 2015;10:e0139947.
24. Senosy SA. Prevalence of HIV among blood donors at Beni-Suef University Hospital Blood Bank, Egypt. J Egypt Public Health Assoc. 2015;90:157–60.
25. Zadsar M, Pourfathollah AA, Rasouli M, Karimi G. Trends in sero-epidemiology of human immunodeficiency virus in voluntary blood donations in Iran, 2008-2013. Arch Iran Med. 2017;20:135–140.
26. Badahdah AM, Sayem N. HIV-related knowledge and AIDS stigma among college students in Yemen. East Mediterr Health J. 2010;16:901–6.
27. Michel K, Ignace B, Elie K, Deddy K, Benjamin K, Oscar L. HIV and HBV seroprevalence in volunteer blood donors in Lubumbashi. SOJ Immunol. 2015;3:1–3.

© 2018 Al-Zubiery et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<http://www.sciencedomain.org/review-history/23350>