



Seroprevalence of *Treponema pallidum* Antibodies among Blood Donors in a Tertiary Hospital in South-South Nigeria

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Authors' contributions

This work was carried out in collaboration between all authors. Author KA designed the study, author OO performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors MI, OI and FJ managed the analyses of the study. Authors CN, EUE, OAB and ANK managed the literature searches. All authors read and approved the final manuscript.

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ABSTRACT

Background: *Treponema pallidum* is well-known for its immune-evasiveness and invasiveness, its spirochaete has a long latent period in which individuals present no signs or symptoms and still could be infectious. In spite of the available effective treatment, the development of suitable diagnostic techniques and implementable preventive strategies, sexually transmitted diseases (STDs) including syphilis, remains major public health problem in Nigeria.

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Aim: The aim of this study is to determine the seroprevalence of *T. pallidum* antibodies among blood donors at the blood bank unit of University of Calabar Teaching Hospital (UCTH), Calabar, Cross River State, Nigeria.

Materials and Methods: Two thousand six hundred and ninety-six blood samples collected from commercial, voluntary and replacement donors were screened for syphilis using the Venereal Disease Research Laboratory (VDRL) particle agglutination test kit. The kits were manufactured by BTNX Inc., Ontario, Canada and onsite Enzyme-Linked Immuno-Sorbent Assay (ELISA) test kit by CTK Biotech (USA) was used in confirming the presence of antibodies of *T. pallidum*. This study was carried out at the blood bank of University of Calabar Teaching Hospital, Calabar from June 2016 to August 2017.

Results: A total of 2695 unit of blood was screened for *T. pallidum* antibody during the study period. Sixty-seven (67) units of blood tested positive giving a seroprevalence of 2.50%.

Conclusion: Our report shows a low seroprevalence of syphilis compared to what has obtained from other parts the country notwithstanding. Improved diagnostics, a better test of cure, intensified public health measures and, ultimately, a vaccine is needed to curb the increasing prevalence of STDs, including syphilis.

Keywords: Seroprevalence; *Treponema pallidum*; donor blood; syphilis; UCTH.

1. INTRODUCTION

Syphilis is a systemic disease caused by the spirochete *T. pallidum*. Previous studies in other African countries reported a high prevalence of *T. pallidum* antibodies among healthy blood donors [1,2]. Blood transfusion is a lifesaving procedure yet with the potential risk of transfusion-transmissible infections (TTIs) and immunological reactions amongst others [3].

The prevention of transfusion-associated infections depends upon proper, pre-donation selection of donors, followed by serologic testing for infectious pathogens, including Hepatitis B Virus, Hepatitis C Virus, HIV/AIDS and syphilis (*T. pallidum*) [4]. A report by World Health Organization (WHO) showed that 12 million people become infected with syphilis each year [5]. The WHO recommends several syphilis screening tests: the enzyme immunoassay (EIA) and *T. pallidum* haemagglutination assay (TPHA) as specific tests, or the Venereal Disease Reference Laboratory (VDRL) and rapid plasma reagin (RPR) as non-specific screening tests [5].

Blood transfusion is a significant route of transmission of syphilis [6]. The paucity of voluntary blood donors in our environment, the dependency on commercial and replacement donors and the lack of highly sensitive and specific screening methods further increases the risk of transfusion-transmissible infections. *T. pallidum* is inactivated when blood and blood products are stored in the refrigerator for 24 hrs. However, the increased demand for blood and blood products does not allow for these products

to be stored beyond 24 hours especially in large facilities like ours. This study, therefore, is aimed to determine the prevalence of *T. pallidum* (syphilis) in donor blood at UCTH, Calabar.

2. MATERIALS AND METHODS

The study is a descriptive one, conducted at University of Calabar Teaching Hospital, Calabar. Data of blood donors between June 2016 and August 2017 were obtained from the donor registry. The facility is mainly dependent on replacement donations and voluntary donor blood sourced mainly from the national blood transfusion services Calabar unit. The donor requirements for replacement donors include age range of 18 – 60 years, weight > 50kg, the absence of any high-risk behaviour, a medical or physiological status that may endanger the donor or recipient, packed cell volume of 40% irrespective of the sex. *T. pallidum* screening was performed using the Venereal Disease Research Laboratory (VDRL) test. The tests were performed and evaluated following the manufacturers manual. Onsite Enzyme-Linked Immuno-Sorbent Assay (ELISA) test kit (strip/device) by CTK Biotech (USA) was used in confirming the presence of antibodies of *T. pallidum*. Adequate volume of plasma was dispensed into the sample pad of the test strip/device, the specimen migrates across the device and if *T. pallidum* antibodies are present, an immunocomplex would be formed with the pre-coated *T. pallidum* antigen on the strip forming a deep red coloured conjugates appearing as a band on the side marked T on the device indicating a *T. pallidum* antibody positive

test result. An absence of the T band insinuates a negative result. The test kit is incorporated with an internal control C-band which should exhibit a deep red colored band of the immunocomplex of Goat anti-Rabbit IgG/Rabbit IgG-gold conjugate regardless of color development on the T band. Otherwise, the test result is invalid and the specimen must be reevaluated with another device. The strip/device is a lateral flow immunoassay for the detection of human antibodies of *T. pallidum* in plasma, serum and whole blood. The test is a qualitative test with high sensitivity and specificity with an accuracy of 99.7%, 99.6% and 99.7% respectively.

The data were analyzed using Microsoft Excel for Windows 2016. Seroprevalence was defined as the proportion of donors serologically confirmed as positives from the total number of donors. The results obtained were presented in charts and tables.

3. RESULTS

A total of 2,695 donors were screened during the study period (June 2016-August 2017) with an average of 192 donors per month. During this period, two thousand two hundred and thirty-one of the blood donors were males donors while four hundred and fourteen were females, giving a male to female ratio of 6:1 (84.60%:15.60%). Majority of the blood donors at our centre were commercially remunerated donors with a total of 1198 (44.45%), replacement donors were 898 (33.32%) while voluntary donors were 599 (22.23%). Of the total 2,695 blood donors during

the study period, only 67 (2.5%) tested positive to the antibodies of *T. pallidum* while the remaining 2628 (97.5%) were negative. The results are presented below.

Majority of the blood received at the blood bank of UCTH were from commercial blood donors 1198 (44.45%), replacement donors were 898 (33.32%) while voluntary donors were 599 (22.23%).

Table 1. Showing the incidence of *T. pallidum* antibodies among the types of blood donor in UCTH

Types of donor	Frequency	Percentage
Commercial	42	62.69
Replacement	16	23.88
Voluntary	9	13.43

The table shows that majority of the blood donors infected by *Treponema pallidum* were the commercial donors having a total of 42(62.69%) of the infected donors. 16(23.88%) were from replacement donors while 9(13.43%) were voluntary donors.

Two thousand two hundred and thirty-one of the blood donors were males while four hundred and fourteen were females, giving a male to female ratio of 6:1. A total of 67 of the donors tested positive to *Treponema pallidum* antibodies. 50(74.63%) males tested positive while 17(25.37%) females tested positive to *Treponema pallidum* antibody.

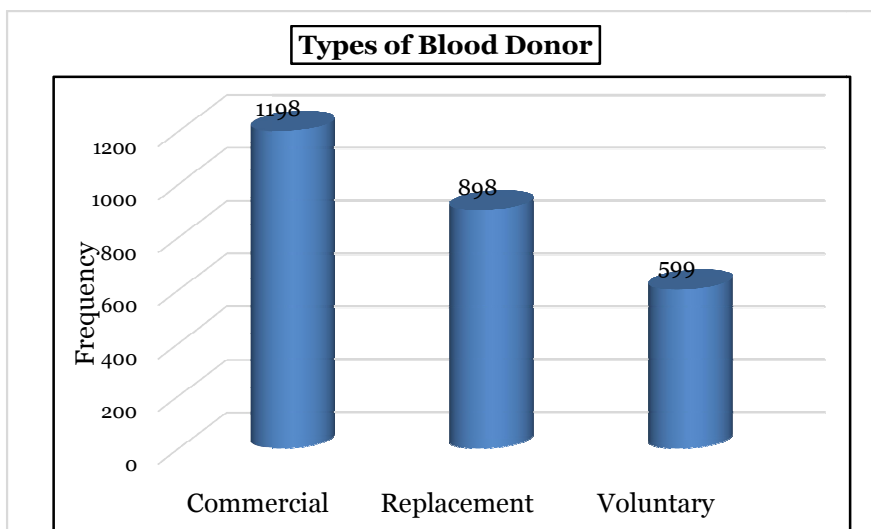


Fig. 1. Showing the types of blood donors in UCTH Calabar

Table 2. Showing the association between gender and *T. pallidum* infection among blood donors in UCTH

Syphilis	Male (%)	Female (%)	Total (%)
Negative	2231 (97.81)	397 (2.19)	2628 (94.58)
Positive	50 (74.63)	17 (25.37)	67 (2.50)
Total	2281 (85.95)	414 (14.05)	2695 (100)

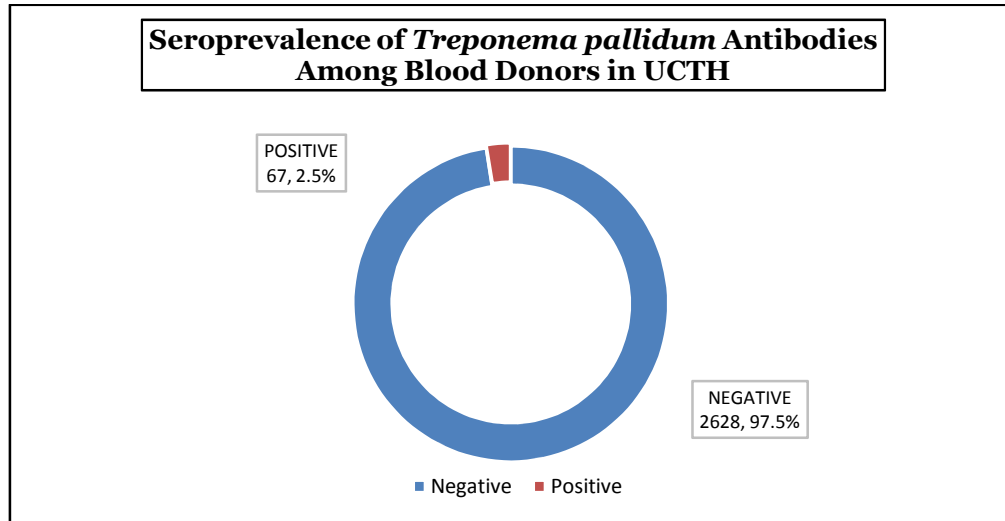


Fig. 2. Showing the seroprevalence of *Treponema pallidum* antibodies among the blood donors

Of the total two thousand six hundred and ninety-five blood donors, two thousand six hundred and twenty-eight of them tested negative for *Treponema pallidum* antibodies while the remaining sixty-seven were positive. Giving a seroprevalence of 2.5% among the study population.

4. DISCUSSION

Syphilis which is transmitted by the spirochaete of *T. pallidum* constitutes a major public health worldwide [7]. The route of transmission of syphilis is almost always by sexual contact, although there may be congenital syphilis via transmission from mother to child in- utero [8]. Syphilis maybe transmitted also via blood and blood products, and intravenous drug use [9]. If not treated, syphilis can cause serious effects such as damage to the aorta, brain, eyes, and bones. In some cases, these effects may be fatal.

The majority of donors tested in this study were commercially remunerated donors (44.45%), rather than replacement donors (33.32%) or voluntary donors (22.23%). Although this is fair when compared with a study conducted in

Osogbo, South-West Nigeria by Fiekumo IB, et al. [10], where commercial donors accounted for 80.9%, replacement 18.3% and voluntary donors were only 0.8%. The amount of voluntarily donated blood has continued to fall over the years in Nigeria, commercial blood donation is the order of the day. Voluntary blood donation has been adjudged the safest source of donor blood procurement however they are limited and cannot sustain the blood requirement of medical practice in most facilities in Nigeria [11]. Most centres have resorted to replacement and paid donors in some instances to meet the increased demand for blood and blood products [11,12]. Contrary to WHO directives that blood donation should be completely voluntary, the center recorded five hundred and ninety-nine (22.2%) as voluntary donation during the period. This proportion is grossly insufficient to meet the blood demands of the hospital. In our setting, replacement and remunerated donations still play important roles in addressing blood insufficiency and should not be discarded in spite of the associated risk. Other measures to increase blood sufficiency such as blood component therapy and rational blood use should be implemented in addition to increase campaign for voluntary donations. The

replacement/remunerated donor population should be counselled and possibly converted and retained as voluntary donors.

In this study the prevalence of *T. pallidum* antibodies was higher among the commercial donors than among replacement and voluntary donors (As shown in Table 1). This observation is consistent with the suggestion by the World Health Organization (WHO) that commercially remunerated blood donors and family replacement donors are more likely to transmit transfusion-transmissible infections than are voluntary donors [13].

The seroprevalence of *T. pallidum* antibodies in this study was 2.50%. This was significantly lower when compared with the seroprevalence that was observed in other part of Africa. In Burkina Faso, a seroprevalence of 3.96% was reported [14], a seroprevalence of 3.7% was reported in Ghana [15], 12.7% was reported in Tanzania [1]. Studies in other parts of Nigeria showed wide difference in syphilis infection [9, 10]. A study in Yola, North- East Nigeria by Olokoba et al reported a prevalence of 1.2%, another study at Ife, Western Nigeria reported the prevalence in the region to be 1.92% following a decline from a previous prevalence of 2.93% [16]. A seroprevalence of 1.7% was reported in Enugu, South Eastern Nigeria [17]. A much lower seroprevalence 1.1% was reported among blood donors in Ilorin [18].

The wide differences in the syphilis infection rate among the blood donors in the different regions within Nigeria, and even those outside Nigeria may be due to the differences in geographical locations, age range of blood donors, sample sizes, the period of time the studies were carried out, and the different socio-cultural practices such as sexual behavior, marriage practices etc which take place in these regions. Access to healthcare and the laboratory test reagents used may also be contributory factors.

5. CONCLUSION

Our report shows a low seroprevalence of syphilis compared to what was obtained from other parts of the country. Notwithstanding, improved diagnostics, intensified public health measures and, ultimately, a vaccine is needed to curb the increasing prevalence of syphilis as well as other STDs. There is a possibility that the difference in seroprevalence can be attributed to geographical variations. *Treponema pallidum*

cannot survive in well-stored blood although the nosocomial infection can still be acquired in centres where blood is not screened for syphilis or stored before use. The emphasis of blood transfusion should be based on two important objectives: (1) protection of human lives and (2) safety. Syphilis screening of donated blood, no matter what the incidence is in the donor population, has been considered to have value as a 'lifestyle' indicator, as individuals exposed to syphilis may also have been exposed to other sexually transmitted diseases and, therefore, should not donate blood for transfusion [19,20,21].

6. RECOMMENDATION

Syphilis (*Treponema pallidum*) testing for blood donors should be implemented so that recipients of blood transfusions would not be at risk of contracting syphilis. Further studies aimed at determining the epidemiology of transfusion-transmissible infections among the general population will be of value in determining the population prevalence.

CONSENT

It is not applicable.

ETHICAL APPROVAL

The research was approved by the Ethical and Institutional Review Board of the University of Calabar Teaching Hospital.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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