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Comparative Study of the Prevalence of Syphilis among Pregnant Women and Prospective Blood Donors in Ekiti State, South Western Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Background: Syphilis is a highly contagious, systemic bacterial illness that poses a serious public health threat on a worldwide scale. In addition to being spread sexually, the illness can also be contracted through blood donation. To accurately evaluate the epidemiological pattern and community impact of the disease, this research sought to ascertain the seroprevalence of syphilis among pregnant women and potential blood donors. In Ekiti State, southwest Nigeria, a comparative study was conducted to determine the frequency of syphilis among expectant mothers and potential blood donors.
Materials and Methods: For this comparison research, which was conducted over a 12-month span, 370 potential blood donors and 300 antenatal enrolees were both selected. After getting each participant's full permission, a questionnaire comprising socio-demographic data was given, and 5 ml of whole blood was drawn by venepuncture into an EDTA bottle. Within seconds, plasma was extracted into a clear receptacle using spinning at 2500g for 5 minutes. ELISA-based fast test tools from Diaspot and Lab Acon were used to find Treponema pallidum. Each sample's reactivity to the two test instruments was read as a positive result, while each sample's lack of reactivity was interpreted as a negative result.
Results: Syphilis seroprevalence among expectant mothers was 2.0% and 0% among female blood donors. Male blood donors had a syphilis seroprevalence of 2.1%, which was comparable to the seroprevalence of 2.0% observed in expectant women.
Conclusion: The screening of potential blood donors and pregnant women for syphilis must be required, available, and cheap as this will improve early detection of the disease for proper therapy. There is a significant correlation between syphilis infection and pregnancy and blood donors.

Keywords: Seroprevalence; pregnancy; blood donors; syphilis.

1. INTRODUCTION

Syphilis is a systemic bacteria disease caused by Spirochaete, Treponema pallidum. It constitutes a major public health challenge globally [1]. Transmission of syphilis can be vertical through mother to foetus during pregnancy or at birth resulting in congenital syphilis [2]. It can also be

horizontal transmission through sexual intercourse with infected person or through parenteral transmission among drug addicts [3]. The disease can also be transmitted through transfusion with infected blood [4]. Treponema infections affect about 36 million people worldwide with an average of 12million new cases yearly [5].

The seroprevalence of the infection in pregnancy is higher in developing countries than in developed countries ranging from 0.02 % in Europe to 4.5% in parts of United States, while 3-18% has been reported in Africa [6,7]. A potential for higher mortality and morbidity with syphilis infection has also been reported through association with HIV infection [8]. WHO reported that about 1million pregnant women have active Treponema infection, while about 1.6 million units of blood were discarded due to transfusion transmissible infections including Treponematoses in 2018 [9,10]. The prevalence of Treponema infection in women of reproductive age group in Africa has been put at 0.36% to 3.6%, while the range among blood donors was 0.71% to 20% [11-13].

Blood transfusion even though a major life saving intervention for both medical and surgical conditions is unfortunately inadvertently a route of transmissible infection with varying degrees of severity. A transfusion transmissible infection is any infection that is capable of transmission from person to person through parenteral administration of blood or its products [14]. Potential blood donors may be asymptomatic for syphilis hence the need for routine screening of all prospective blood donors and not only those that are of high risk behaviours. Window period of the infection is also a major challenge due to absence of the necessary serological markers to detect the infection during this period [15-17]. Provision of constant and safe blood has been a major challenge in the developing countries with high prevalence of transfusion transmissible infections. Lack of adequate voluntary blood donors, poor storage facilities due to irregular power supply contributed adversely to the availability of safe blood in the developing countries like Nigeria [18-20].

Incidence of syphilis infection is found to be higher in pregnant women who did not receive adequate antenatal care [21]. Adverse effects of maternal syphilis infection on the foetus may be fatal ranging from spontaneous abortion, low birth weight, still birth, congenital abnormalities and neonatal deaths [22]. Asymptomatic infected population stands the risk of potential reservoirs of the infection if not detected and treated [23]. Screening for syphilis during antenatal is therefore considered to be very cost effective in improving children's health [24]. In view of the potential risk of congenital syphilis infection and its attendant public health burden, there should be National guideline policy in Nigeria for routine antenatal screening [25,26].

The objective of this comparative study therefore was to determine the epidemiological pattern of this disease under a broader scope by comparing the prevalence of syphilis in pregnant women with the prevalence in prospective blood donors in order not to underestimate the population burden of this public health challenge.

The findings of this research are anticipated to confirm the pressing need for Nigeria to develop national guidelines for antenatal syphilis screening of all blood donors and all pregnant women.

2. METHODOLOGY

2.1 Study Locations

The study was carried out in the departments of Haematology and Blood Transfusion as well as Obstetrics and Gynaecology at Federal Teaching Hospital, Ido Ekiti (FETHI), Ekiti State, and Ekiti State University Teaching Hospital (EKSUTH).

Ekiti State is in the south western region of Nigeria. It is located between longitudes 4° 45° and 5° 45° East of the Greenwich meridian and latitudes 7° 15° and 8° 15° North of the equator. The state has three senatorial districts (Ekiti North, Ekiti South and Ekiti Central) and 16 local government areas. Most of the indigenes of the state are Christians with a few Muslims and traditional worshippers. The indigenous people of the state speak Ekiti dialect and Yoruba fluently. Most Ekiti indigenes are farmers while a very few others are public servants and small scale business owners.

Federal Teaching Hospital, Ido Ekiti is one of the two tertiary health institutions in the state and is located at Ido Osi local government Area. Ekiti State University Teaching Hospital is located at the heart and capital of the state, Ado Ekiti which is the urban and industrial centre of the region. The two hospitals have well established

departments of Haematology/Blood transfusion and Obstetrics /Gynaecology which cater for the teeming population of the state.

2.2 Sampling Technique

Consecutive sampling technique was adopted to enable enough samples to be collected until the desired number for study was reached. That was done to mitigate the negative impacts of COVID-19 pandemic era on recruitment of participants.

2.3 Sample Collection

Five millilitres of whole blood samples were collected by venipuncture from 370 blood donors and 300 antenatal patients and dispensed into EDTA blood collection tubes following informed consent. Plasma was immediately separated into a plain container from whole blood by subjecting the sample to centrifugation at 2,500g for 5 minutes.

2.4 Inclusion/Exclusion Criteria

The research included all potential blood donors and antenatal attendants who provided full permission, had no prior history of syphilis, and fell within the age ranges of 15–48 years and 18–65 years for potential blood donors and attendees, respectively. The study excluded blood donors who had a history of syphilis, did not meet the requirements for blood donation, such as weighing less than 50 kg for 450 ml of donation, having haemoglobin levels below 13.5 g/dL for male blood donors and below 12.5 g/dL for female blood donors, and having a chronic illness in their past or present. Non-pregnant women and antenatal participants who were receiving syphilis treatment or had a history of syphilis were also removed from the research.

2.5 Serological Assays

Treponema pallidium were detected using Diaspot and Lab Acon ELISA-based rapid test devices. Two reactive cases from the two test devices were interpreted as positive results while two non-reactive results were interpreted as negative. Use of known positive and negative controls served as part of quality control measures to optimize quality data. Analyses were carried out according to the manufacturers' instructions.

2.6 Statistical Analyses

Research code was assigned to each questionnaire containing the sociodemographic and analytical data generated for ease of data entry and validation. Statistical Package for Social Sciences version 21 was used to analyze data and results were presented tables and charts. Data were saved indifferent formats and storage media as back-ups to prevent data loss.

3. RESULTS

Table 1 shows the demographic characteristics of antenatal patients and prospective blood donors screened for syphilis.

A total number of three hundred (300) antenatal enrolees were screened for syphilis. Fifteen percent (15%) of this population were primigravida while 85% of them were multigravida.

96.3 % of this population had at least secondary education while 3.7 % had primary education.

The prospective blood donors screened for syphilis were 370 and they were mainly replacement blood donors. Replacement blood donors constituted 95.4% while voluntary blood donors constitute 4.6%.

The prospective blood donors were mainly male, 88.1% while the females constituted 11.9 %. Prospective donors with at least secondary school education were 85.1% while the remaining 14.9% had only primary school education.

Table 2 compared the age distribution of the antenatal enrolees with the prospective blood donors.

The highest age distribution for antenatal enrolees was age group 30- 34years which constituted 38.3 % of the total participants while ages less than 20years and 45- 49years constituted the least percentage of 0.7%respectively. The highest percentage of the blood donors were between the ages 25-29 years and it constituted 21.9 % while ages greater than 55years constituted 0.3% of the blood donors. There was a statistically significant difference in the age groups of antenatal attendees and prospective blood donors.

Table 3 compares the overall syphilis seroprevalence among antenatal enrollees and prospective blood donors.

Overall syphilis seroprevalence among antenatal enrollees was 2.0% and the highest syphilis seroprevalence was reported among antenatal patients within the 35 – 39 years' age group. It was 0% among apparently healthy female blood donors. Comparison of syphilis seroprevalence between antenatal patients and female prospective blood donors (non-pregnant women) showed that infection with syphilis was associated with pregnancy. Overall syphilis seroprevalence among male prospective blood donors was 2.1% and that was not comparatively different from the finding among pregnant women.

Table 1. Demographic characteristics of antenatal patients and prospective blood donors screened for syphilis

Demographic variable	Mean age (Mean ± SD)	Absolute Number (%)
Total number of Antenatal Attendees	31.3 ± 0.3	300 (100.0)
Study Site:		
EKSUTH		140 (46.7)
FETHI		160 (53.3)
Gravidity		
Primigravida		15 (5.0)
Multigravida		285 (95.0)
Educational Status of Antenatal Attendees:		
At most primary education		11 (3.7)
At least secondary education		289 (96.3)
Total Number of Prospective Blood Donor Screened		370 (100.0)
Type of Blood Donors		
Voluntary Blood Donors		17 (4.6)
Replacement Blood Donors		353 (95.4)
Sex:		
Male		326 (88.1)
Female		44 (11.9)
Educational Status of Antenatal Attendees:		
At most primary education		55 (14.9)
At least secondary education		315 (85.1)

KEY: EKSUTH = Ekiti State University Teaching Hospital; FETHI = Federal Teaching Hospital, Ido-Ekiti; SD = Standard deviation; % = Percentage

Table 2. Comparison of the number of antenatal and prospective blood donors participants according to Age Groups

Age group (In years)	Antenatal patients number (percent)	Blood donors number (percent)	Percentage	P Value
< 20	2 (0.7)	8 (2.2)	1.5	
20 – 24	20 (6.7)	74 (20.0)	13.3	
25 – 29	94 (31.3)	81 (21.9)	- 9.4	
30 – 34	115 (38.3)	80 (21.6)	16.7	**0.006**
35 – 39	54 (18.0)	68 (18.4)	0.4	
40 – 44	13 (4.3)	39 (10.5)	6.2	
45 – 49	2 (0.7)	16 (4.3)	3.6	
50 – 54	0 (0)	3 (0.8)	0.8	
≥ 55	0 (0)	1 (0.3)	0.3	
Total	300 (100.0)	370 (100.0)	42.7	

Table 3. Comparison of the seroprevalence of syphilis according to number and age groups of antenatal attendees and prospective blood donors

Age Group (in years)	Antenatal Attendees N (%)	Antenatal Attendees Seropositive for Syphilis N (%)	Male Blood Donors N (%)	Male Blood Donors Seropositive for Syphilis N (%)	Female Prospective Blood Donors N (%)	Female Prospective Blood Donors Seropositive for Syphilis N (%)
≤ 20	2 (0.7)	0 (0)	4 (1.2)	0 (0)	4 (9.1)	0 (0)
20 – 24	20 (6.7)	0 (0)	68(20.9)	2 (0.6)	6 (13.6)	0 (0)
25 – 29	94 (91.3)	1 (0.3)	74 (22.7)	3 (0.9)	7 (15.9)	0 (0)
30 – 34	115 (38.3)	1 (0.3)	71 (21.7)	1 (0.3)	9 (20.5)	0 (0)
35 – 39	54 (18.0)	4 (1.3)	60 (18.4)	1 (0.3)	8 (18.2)	0 (0)
40 – 45	13 (4.3)	0 (0)	33 (10.1)	0 (0)	6 (13.6)	0 (0)
45 – 49	2 (0.7)	0 (0)	12 (3.7)	0 (0)	4 (9.1)	0 (0)
50 – 54	0 (0)	0 (0)	3 (0.9)	0 (0)	0 (0)	0 (0)
≥ 54	0 (0)	0 (0)	1 (0.3)	0 (0)	0 (0)	0 (0)
Total	300 (100.0)	6 (2.0) †	326 (100.0) ††	7 (2.1) †††	44 (100.0)	0 (0)

Key: † = Approximate syphilis seroprevalence among antenatal patients
†† = Approximate percentage of male blood donors
††† = Approximate Syphilis seroprevalence was predominantly among male replacement blood donors

4. DISCUSSION

Syphilis constitutes a global public health problem and hence determination of the epidemiological pattern on a broader scope is required to avoid underestimation of the disease burden.

This comparative study of the prevalence of the disease among pregnant women and prospective blood donors' findings has shed more light on the infection rate and spread of this disease which is strategic to adequate planning towards elimination of the congenital transmission of Treponema infection as proposed by World health organization [27].

Findings in this study corroborated the fact that infection of syphilis is highly associated with pregnancy and blood transfusion [28,29].

Overall syphilis seroprevalence among antenatal enrolees was 2.0%. This finding is relatively lower than the findings in the previous systematic review done in Sub Sahara Africa among pregnant women where the prevalence was reported as 4.5% [30,31]. The value was even found to be higher among incarcerated women and Australia aboriginal populations where the prevalence was 6.1 and 16.8 respectively [32,33]. However, a study conducted by O.A Olowe et al on the prevalence of syphilis among pregnant women in two Health care facilities in the same south western Nigeria in 2014 recorded a lower value of 1.0% [34]. Seroprevalence of 1.8% was reported among pregnant women in India, a value that is relatively close to our finding in this study [35]. It is of note that the prevalence of syphilis is relative to the degree of risk profiles of the population involved in any study as well as the culture and traditional practices of the people, which may account for this variance in seroprevalence findings. hence the higher values recorded in Australia aboriginal populations and incarcerated women [36].

The seroprevalence of syphilis among female blood donors was found to be zero while it was 2.1 in male blood donors. The zero seropositivity recorded in female donors may be due in part to the participants' gender disproportionality which skewed towards the male population. However, this finding of gender seroprevalence inequality was not different from the study carried out in in Northwest Ethiopia where the overall seroprevalence of syphilis among blood donors was found to be 1.2% with 1.5 % and 0.7% in male and female respectively [37]. The higher seroprevalence finding in male over female have also been reported in previous studies carried out in North Showa [38] and Gondar [39]. This relative higher seropositivity in males may be attributed to increased risk behaviour such as multiple sexual partners and substance abuse among males than females. Our study showed that only 4.6% of the prospective blood donors screened were voluntary blood donors while 95.4% were replacement blood donors of which the bulk are usually commercial donors. Findings showed that some of these commercial donors are subjects of economic crisis with attendant low socioeconomic status and risky practices like sharing of personal care items, unprotected sexual intercourse with multiple sexual partners.

Comparison of syphilis seroprevalence in our study between antenatal patients (2.0) and female prospective blood donors (0) showed that infection with syphilis is associated with pregnancy [40]. The overall syphilis seroprevalence among male prospective blood donors, 2.1% that was found not to be comparatively different from the seroprevalence among pregnant women may insinuate that transfusion transmissible syphilis remains the main cause of seropositivity of syphilis among antenatal patients.

5. CONCLUSION

In view of the strong association of syphilis infection with pregnancy and blood donors, screening of prospective blood donors and pregnant women for syphilis must be mandatory, accessible and affordable as this will ensure early detection and treatment of infected individuals and their partners thereby reducing the prevalence or eliminating this global public health problem with all the attendant complications especially in the unborn child.

Advocacy, counselling and public awareness about the mode of transmission and spread of this global health problem, syphilis, must be well established in all Obstetric clinics and donors section of all blood banks in order to reinforce the need for routine screening of syphilis in antenatal women and prospective blood donors.

CONSENT

Informed consent was obtained from all the participants in this study.

ETHICAL APPROVAL

This study was approved by the Human Research and Ethics Committee of the Federal Teaching Hospital, Ido Ekiti and Ekiti State University Teaching Hospital, Ado Ekiti. Confidentiality of all information and Anonymity were ensured.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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