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Clinical and Biological Profiles of Prospective Blood Donors at the Yaoundé Central Hospital and the Yaoundé University Teaching Hospital

Profils cliniques et biologiques des futurs donneurs de sang à l'hôpital central de Yaoundé et au CHU de Yaoundé

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ABSTRACT

Assessing the profiles of prospective donors could help develop strategies to improve blood safety in our context. This study aimed to evaluate the clinical and biological profiles of prospective Cameroonian blood donors. To attain this objective, we carried out a cross-sectional and analytical study on all prospective blood donors that presented at the Yaoundé Central Hospital (HCY) and Yaoundé University Teaching Hospital (YUTH) blood banks from January 2017 to May 2017. After obtaining participants' consent, we collected information from them, examined them, and collected five-milliliter blood samples from each of them. These blood samples were used to test for HIV, HBV, HCV, and Syphilis. A total of 247 prospective donors were retained for the study. We found that group "O" was noted in 50.9% of the participants and 97% were Rhesus-positive. Of the four main transfusion transmissible infections (TTIs) screened, 57 participants tested positive for at least one; nine were tested positive for HIV, twenty-six for HBV, ten for HCV, and sixteen for Syphilis. Co-infection was noted in four of the participants with two of them testing positive for both HIV and HBV, one for both HIV and HCV, and one for both HCV and Syphilis. On univariate analysis, a significant association was found between lymph nodes measuring more than 2 cm and the presence of a TTI. The presence of lymph nodes measuring more than 2 cm was associated with the presence of a TTI.

RÉSUMÉ

L'évaluation des profils des donneurs potentiels pourrait aider à développer des stratégies pour améliorer la sécurité du sang dans notre contexte. Cette étude visait à évaluer les profils cliniques et biologiques des candidats donneurs de sang camerounais. Pour atteindre cet objectif, nous avons mené une étude transversale et analytique sur tous les candidats donneurs de sang qui se sont présentés aux banques de sang du Centre Hospitalier Central de Yaoundé (HCY) et du CHU de Yaoundé (YUTH) de janvier 2017 à mai 2017. Après obtention des participants ' consentement, nous avons recueilli des informations auprès d'eux, les avons examinés et prélevé des échantillons de sang de cinq millilitres sur chacun d'eux. Ces échantillons de sang ont été utilisés pour tester le VIH, le VHB, le VHC et la syphilis. Au total, 247 donneurs potentiels ont été retenus pour l'étude. Nous avons constaté que le groupe « O » était noté chez 50,9 % des participants et 97 % étaient rhésus positifs. Sur les quatre principales infections transmissibles par transfusion (ITT) dépistées, 57 participants ont été testés positifs pour au moins une ; neuf ont été testés positifs pour le VIH, vingt-six pour le VHB, dix pour le VHC et seize pour la syphilis. Une co-infection a été notée chez quatre des participants, dont deux étaient positifs à la fois pour le VIH et le VHB, un pour le VIH et le VHC et un pour le VHC et la syphilis. En analyse univariée, une association significative a été retrouvée entre les ganglions mesurant plus de 2 cm et la présence d'un ITT. La présence de ganglions mesurant plus de 2 cm était associée à la présence d'un ITT.

INTRODUCTION

Blood safety, as defined by the World Health Organization (WHO), is the adequate and timely provision of safe blood and its products to all those in need as part of their treatment.[1] Blood safety is a problem in settings where the demand for blood is high. According to the WHO, although most blood donations occur in developed countries, the greater part of this blood is consumed in developing countries where only 3.9 donations per 1000 persons occurs.[2] Moreover, countries in sub-Saharan Africa (SSA) have a high prevalence of diseases that affect the health of blood donors, especially hepatitis B.[3] Therefore, the first and most crucial step in blood safety is the medical selection of blood donors, as it entails choosing a healthy donor to safeguard the donor's health and reduce the risks of infections and immunologic complications. Blood donor medical selection also reduces the unnecessary deferral of safe and healthy donations and minimizes waste of resources due to unsuitable donations.[4] In our context, blood safety is implemented by the blood banks and the hospitals that host them, especially as the largest blood banks are hospital-based banks.[5] This means they are not autonomous; thus, they have limited budgets and completely depend on the hospital administration for their functioning, making the implementation of blood donor education, motivation and recruitment irregular while rendering repeat donor strategies inefficient, all of which do not favor voluntary donations. The profiling of prospective blood donors helps to generally assess the risk of infection which can greatly boost blood safety. Although one of the characteristics of a transfusion transmitted infection (TTI) is an asymptomatic phase or the presence of only mild signs that are not always detectable during the blood donor[4] identifying these mild signs can also greatly assist in the medical selection process.

This study aimed to obtain some data on not only the biological profiles of prospective blood donors but also the clinical profiles of these donors at the blood bank in resource-limited settings.

METHODS

This was a cross-sectional analytical study carried out from January 2017 to May 2017 at the blood banks of the Yaoundé University Teaching Hospital (YUTH) and the Yaoundé Central Hospital (YCH). Following approval from the Institutional Review Board of the Faculty of Medicine and Biomedical Sciences and from the appropriate institutional authorities, a convenience sampling (not randomised) method was used for data collection. Prior to medical selection, all prospective donors were informed of the selection criteria for blood donors, the risk factors of transfusion transmitted infections (TTIs) and the signs and symptoms of the four main TTIs. For every candidate, the inclusion criteria for the study were: all prospective donors that presented at both blood banks between the ages of 18 years and 65 years old. We excluded those whose last blood donations was less than three months for men and less than four months for women. We collected data on the baseline information, the socio-demographic profile, social profiles (including if the donor acquired some scarifications less than three months ago, condom use during sexual intercourse and other sexual behaviors like oral sex, anal sex) immunological profiles (number of previous blood transfusions received), surgical, family and medical profiles of each study participant at the medical selection office at each blood bank, after which a complete physical examination was done for each of them by a General Practitioner, in search of any clinical manifestations of the four main TTIs, and other incidental findings. Some of the manifestations we checked for were:

HIV:

Symptoms:

- Low-grade fever (temperature >37.5-38℃)

Signs:

- Generalized rash (papular eruptions at the trunk and arms
- Generalized lymphadenopathy (enlargement of more than two noncontiguous lymph node groups)
- Wasting syndrome: chronic diarrhea and weight loss of no identifiable cause (loss of 10kgs and above for more than three months)
- Recurrent Candidiasis (more than three infections in a year
- Chronic cough (dry or productive cough for more than 2 weeks)
- Past history of shingles

HBV and HCV:

Symptoms

- Alteration in taste (difference in taste of more than one food item from a previously well-known perception)

Signs

- Jaundice (observed by the donor and researcher)
- Hepatomegaly (tender or non-tender)
- Splenomegaly
- Palmar erythema
- Spider nevi
- Muscle wasting
- Ascites
- Peripheral edema
- Gynaecomastia
- Testicular atrophy
- Abdominal collateral veins (caput medusa)

SYPHILIS:

- Painless chancres on the glans penis, vulva or cervix, anus, fingers, oropharynx, tongue, and nipples.
- Regional non-tender or generalized lymph adenopathy
- Localized or diffuse mucocutaneous rash (non-pruritic and bilaterally symmetrical)
- Patchy alopecia
- Condyloma

All findings on physical examination for each donor were recorded on their respective worksheets. We went on to screen each donor for each of the four main TTIs at the blood banks of the YUTH and the YCH. We followed the standard screening protocol which is the same for both blood banks. The screening comprised of rapid determination testing assays and electroimmunoassay (EIA) techniques for HIV. Screening for HBV and HCV was based on rapid determination testing assays and EIA techniques. For HIV, HBV and HCV, when both rapid diagnostic tests (RDTs) and ELISA were both reactive, the donor was considered to have tested positive (the presence of disease was established but the diagnosis needed to be confirmed a third time either by a repeat ELISA or PCR) for the disease. The same concept was such that if RDT and ELISA were non-reactive, the donor was considered to be negative. However, when one assay was reactive while the other was non-reactive, the status of the donor was considered "indeterminate" and one of the assays needed to be repeated to confirm the presence of the infection in question. All indeterminate cases of HIV, HBV, and HCV were excluded from our analysis.

The TPHA test was used to screen the donors for syphilis. All reactive samples were considered positive and non-reactive ones were considered negative. All the screening was conducted using internal quality control and followed an approved algorithm. The findings obtained on physical examination were reported together with the distribution of TTIs in the study population.

A univariate analysis was carried out with each exposure variable, with the presence of a TTI being the outcome variable. Continuous variables were presented as mean values and standard deviations for normally distributed data and as median values with interquartile ranges for skewed data. The chi-square test was used to compare proportions for frequencies ≥ 5. Fischer's exact test was used for frequencies < 5. P-values of less than 0.05 were considered to be statistically significant. The strength of the associations between exposure variables and the presence of a TTI was quantified using the odds ratio (OR). Significant associations were those in which the odds ratios were either strictly greater than or strictly less than 1, for p-values of less than 0.05.

RESULTS

Socio-demographic Profile

A total of 247 prospective donors were recruited from both study sites and their questionnaires were analyzed. Their ages ranged from 18 years to 55 years with a mean value of 30.1 ± 8 years. The 26 to 35-year age group, which constituted 48.2% of the study sample, was the most represented (Figure1). Males constituted the majority of the study sample (217; 87.9%), and most of the blood donors had attained secondary education (95; 38.5%) and university education (96; 38.9%). Family (replacement) donors constituted the majority of the study population, with 215 (87%) donors. A total of 117 (47.4%) donors were donating blood for the first time. These details are presented in Table I.

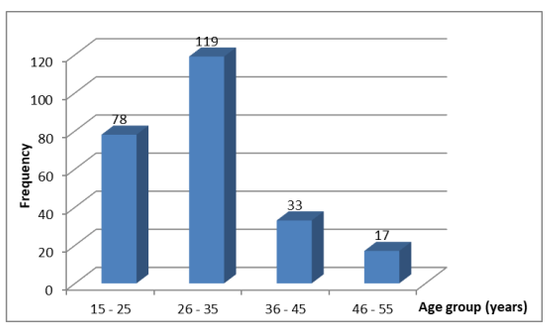

Figure 1: Distribution according to age group

Table I: Distribution according to TTIs

Variables	Frequency (n)	Percentage (%)
HIV results		
Reactive	9	3.6
Non-reactive	236	95.6
Indeterminate	2	0.8
HBV results		
Reactive	26	10.5
Non-reactive	219	88.7
Indeterminate	2	0.8
HCV results		
Reactive	10	4
Non-reactive	236	95.6
Indeterminate	1	0.4
Syphilis results		
Positive	16	6.5
Negative	231	93.5
HIV and HBV		
Yes	2	0.8
No	245	99.2
HCV and Syphilis		
Yes	1	0.4
No	246	99.6
HIV and HCV		
Yes	1	0.4
No	246	99.6
At least one infection		
Yes	57	23.1
No	190	76.9

Table II: Distribution of each TTI according to signs and symptoms

Variables	Transfusion Transmitted Infection					
	HIV n(%)	Hepatitis B n(%)	Hepatitis C n(%)	Syphilis n(%)	No infection n(%)	Total n(%)
Weight loss	0	0	0	1(16.7)	5(83.3)	6(100)
Maculae	0	1(33.3)	0	1(33.3)	1(33.3)	3(100)
Alteration taste	0	1(100)	0	0	1	1(100)
Lymph node size >2cm	3(37.5)	3(37.5)	1(12.5)	1(12.5)	0	8(100)

Blood Donor Clinical Profile

Of the 247 blood donors, three (1.2%) had scarifications in the past 12 months, 33 (13.4%) admitted to having more than one sexual partner in the past 12 months, and 152 (61.5%) regularly used condoms during sexual intercourse. Also, 18 (7.3%) of our study participants had once had a sexually transmissible infection (Syphilis, Gonorrhea and Chlamydia) and 7 (2.8%) of them had been transfused at least once.

A total of 208 (84.2%) of our study participants tested negative to HIV prior to the study. More than half of our had participants had never been screened for either hepatitis B (147, 59.5%) or hepatitis C (173, 70%) and 92.3% (228) of them had not taken any dose of the Hepatitis B vaccine. We registered 3 (1.2%) hypertensive and 4 (1.6%) diabetic participants.

The mean weight of the participants was 75.6 ± 13.7 kg with the 65-75kg weight range being the most represented (89, 36%) among blood donors. The mean pulse was 80.8 ± 35.5 bpm with the 70-80 pulse range being the most represented with 79 (32%). The mean systolic blood pressure was 130 ± 13.33 mmHg, with the most represented range being the 120mmHg-130mmHg 70, (28%). The mean diastolic blood pressure was 78.3 ± 9.6mmHg, with the most represented range being 70-80 mmHg 96 (38.9%). The mean temperature was 37 ± 0.34℃ and the most represented range was 36.8-37℃ with 58 (23.5%).

Concerning the clinical signs and symptoms, six (2.4%) of the participants had lost weight in the past three months, one (0.4%) had an alteration in taste, and eight (3.4%) had lymphadenopathy size greater than 2 cm. Also, three (1.2%) of the participants had maculae, and pallor was noted in one (0.4%) participant. These details are presented in Table II.

Blood Donor Biological Profiles

The mean haemoglobin level was 15.2 ± 1 g/dL with the most represented group 15-20 g/dL with 113 (53.8%). Eleven (5.2%) of our participants, who were all males, were anaemic.

More than half of our participants (50.9%) were of blood group "O" and 97% had the D antigen (Rhesus positive).

A total of 57 (23.1%) participants were reactive for at least one of the four TTIs. Of the 57 reactive cases, nine (3.6%) were reactive for HIV, 26 (10.5%) were reactive for HBV, 10 (4%) were reactive for HCV and 16 (6.5%) were positive for Syphilis.

Co-infections were found in some participants; two (0.8%) of the participants to both HIV and HBV, one (0.4%) had both HIV and HCV and one (0.4%) participant had both HCV and Syphilis. These details are presented in Table I.

Distribution of TTIs according to donor type

Of the 57 reactive participants, 50 (22.9%) of the 215 family donors were reactive for at least one TTI and seven (21.9%) of the benevolent donors were reactive for at least one TTI. These details are illustrated in Figure 2.

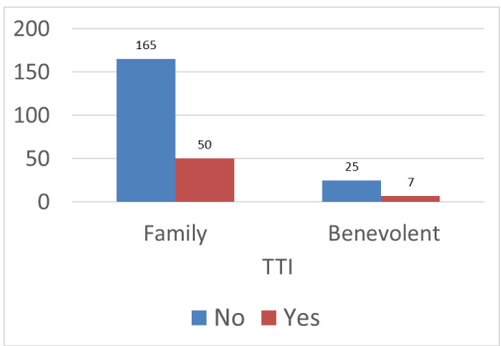

Figure 2: Distribution of TTIs according to donor type

Distribution of TTIs according to clinical sign and symptom

The only participant that had an alteration in taste was reactive to hepatitis B.

Of the eight participants who had a lymph nodes measuring more than 2cm, three were reactive to HIV, three to HBV on screening, one to HCV and one to syphilis. Of the six study participants who lost weight in the past 3 months, one had syphilis and of the three participants which had maculae, one was reactive to hepatitis B and one was positive for syphilis. These details are presented in Table II.

Table III: Association between number of donations, lymph node size and having a TTI.

	Transfusion Transmissible Infection			
	Yes n(%)	No n(%)	OR [95% CI]	P-Value
Previous donations				
≥ 2	5(13.2)	33(86.8)	0.46 [0.17-1.23]	0.08
< 2	52(24.9)	157(75.1)		
Lymph node size				
≤2 cm	51(21.3)	188(78.7)	0.0904 [0.0177-0.4615]	0.0023 HIV(0.017) HBV(0.0407)
>2 cm	6(75)	2(25)		

Association of between different factors and having a TTI

No significant association (p = 0.08) was found between having donated blood no more than once and having a TTI. Nevertheless 24% of those who had donated blood no more than once had at least a TTI compared to 13% who had donated at least twice (Table III). A significant association (p=0.0023) was found between the presence of lymph nodes measuring more than 2 cm and having a TTI, and in particular, reactive to HIV or Hepatitis B (p=0.017 and p=0.0407, respectively) as shown in table III.

DISCUSSION

The mean age was 30.1 ± 8 years. There was a male predominance with a sex ratio of 7.2: 1. This is similar to the findings of Ankouane et al. who reported a mean age of 28 years and sex ratio of 14: 1[6] and of Tagny et al., who reported a mean age of 29 ± 11 years and sex ratio 4.6: 1.[7]

Studies carried out in Africa by Tagny et al.,[3] Allain et al.,[10] Nébié et al.[11] reported similar results however, the age and sex ratio differ from those reported in European countries as the proportion of blood donors under 35 years was less than 50% in France and less than 45% in Finland and Switzerland.[8] Moreover, female accounted for 40% in Austria, 49·7% in France, 50% in Norway, and 55% in Great Britain.[8] In the African context, there is a general belief that men are healthier than women as reported by Nébié et al. This may explain the tendency for more men to donate blood than women. In addition, women are said to make monthly blood donations to nature through their menstrual cycles. Other obstetrical factors including pregnancy and breastfeeding, also prevent many women from donating blood. Furthermore, Mandisodza et al. explained that the voluntary donor programs in Africa tend to be centered on secondary school and university students.[9] Allain et al. demonstrated donor ages tend to be associated with the donor type as the median ages for secondary school, public blood drive and family replacement donors were 18, 25 and 32 years, respectively.[10] This trend was reflected in our study as 38.9% of our participants had attained university education and 38.5% of them had attained secondary education 2.4% were not educated. Nevertheless, our results were different from those reported by Nébié et al. in 2007, in which more than 31% of their donors were either uneducated or received only primary education.[11] This could be explained by the fact that Nébié et al. carried out their study more than a decade ago and literacy rates across Africa have increased overtime with Cameroon having a literacy rate of 83.8% among people aged 15-24 years.[12] Most of our study participants were family donors and first-time donors, a similar finding to those of Ankouane et al. and Tagny et al. Interestingly, Mbanya et al. reported that findings in first-time voluntary non-remunerable blood donors were comparable to those in family donors.[13] In the present study, first-time donors represented 47.4% of the donor population, which may further explain the high prevalence of TTIs observed.

The body weights, pulse rates, blood pressures and temperatures of our study participants were all suitable for donation, as the mean body weight of the participants was 75.6 ± 13.7 kg, the mean pulse rate was 80.8 ± 35.5 beats/minute, the mean systolic blood pressure was 130 ± 13.3 mmHg, the mean diastolic blood pressure was 78.3 ± 9.61 mmHg and the mean temperature was 37 ± 0.3 ℃.

For symptoms, six (2.4%) study participants who noted weight loss in the past three months, one (16.7%) had a TTI (Syphilis). The only participant who had as symptom, an alteration in taste was reactive to Hepatitis B. Although these are non-specific symptoms of infectious disease these donors presented before donation, they are not enough to conclude on the presence of TTIs.[14]

For the signs, enlarged lymph nodes measuring 2 cm and maculae were signs of disease identified during physical examination. Of the three participants who had maculae one (33.3%) tested positive for Hepatitis B and another (33.3%) was positive for syphilis. Maculae are characteristic of secondary syphilis and indicates of spirochete multiplication in the body.[15]

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The primary function of lymph nodes is to filter out microorganisms and abnormal cells that have collected in the lymph. Lymph node enlargement (size > 2cm) is a common feature of a variety of diseases and may serve as a focal point for subsequent clinical investigation of diseases of the reticuloendothelial system or as an

indicator of regional infection. One of the common causes of lymphadenopathy is reactive lymphadenitis (42.6%) which is a benign response to localized or systemic infection.[16]

With anaemia being defined as a haemoglobin level of less than 12 g/dL in women and less than 13 g/dL for men, eleven (5.2%) participants had anemia. All of the anemic blood donors were male. This is similar to findings reported by Tayou et al. after evaluating two methods of haemoglobin measurements.[17]

The phenotypes of the participants in the blood group systems were similar to the ones reported by Jeremiah et al., with blood group O being the most common blood group, occurring in 50–80% and the D antigen being present in more than 90% of blood donors.[18]

We found a high prevalence of TTIs, with our results were similar to those of Fouelifack et al., Tagny et al., Ankouane et al., and Tagny et al. The most frequent serological identified was the HBsAg. We did not have any case of co-infection with up to three TTIs. This could be because our study sample was up to 18 times smaller than the ones used in the previously mentioned studies.

Unlike Zachariah et al.[19] who found a significant association between age, level of education, profession and marital status and the presence of a TTI, we did not find any such association. This could be because our study sample was six times smaller than the one used in the previously mentioned study.

Moreover, we found no significant association between regular condom use, the number of sexual partners, prior STIs, and prior knowledge of HIV status, hepatitis B status, hepatitis C status, scarification in the past twelve months, professional exposure to TTIs, and the presence of a TTI possibly because of our small sample size. Nevertheless, most of our participants 84.2% had been screened for HIV at least once as strategies aimed at bringing care to people that are currently implemented in our context. This is usually done by the setting up of mobile HIV testing units.[20]

No significant association was found between having donated blood no more than once previously and having a TTI. Nevertheless, 24% of those who had donated no more than once had at least one TTI compared to 13% of those who had donated at least twice (p=0.08). In 2010 Mbanya et al. reported that findings in first-time VNRBD were comparable to those in family donors.[13] In the present study, first-time donors represented 47.4% of all donors, which may further explain the high prevalence of TTIs we observed.

A significant association was found between the presence of lymph nodes measuring more than 2 cm and having a TTI (p=0.0023), especially HIV (0.0017) and hepatitis B (0.0407). In 2007, Malhotra et al. reported that lymph node enlargement (size > 2cm) is a common feature in a variety of diseases as it is a benign response to localised or systemic infection. One of the common causes of lymphadenopathy is reactive lymphadenitis (42.6%) which is a benign response to localized or systemic infection.[16] This benign response to systemic infection can hence be exploited during medical selection to help avoid the collection of infected blood which needs to be destroyed after screening at the blood bank.

CONCLUSION

The prevalence of TTIs is still high in our setting (23.1%) as most of the blood donors presenting at our blood banks are family donors and first-time donors. This is also due to the inaccuracy exhibited by prospective blood donors in answering questions during the selection process.

The sensitization of the general public on blood donation needs to be intensified with the emphasis being laid on voluntary non-remunerated blood donations. Blood bank staff need to pay more attention to first time donors and family donors.

Our study suggests that regular blood donation decreases the prevalence of TTIs among blood donors and prospective blood donors with lymph nodes size greater than 2 cm are more likely to have a TTI.

STUDY INFORMATION

Study limitations

Since the blood banks function mostly with replacement donors, blood products shortages at both blood banks reduced the possibility of a larger sample size.

Some prospective blood donors were not comfortable about being examined and declined clinical examination.

Some prospective blood donors were not truthful for fear of being deferred were not truthful. We better questioned most prospective blood donors after their TTI results.

Ethical approval

Ethical clearance was obtained from the ethical committee of the Faculty of Medicine and Biomedical Science, Yaoundé 1.

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Author contributions

This study was conceived and designed by E.M.T, C.T.T, A.N.N, F.N.S. Data was collected by E.M.T while analysis was carried out by C.A.A. The manuscript was written by E.M.T and C.A.A and critical review of the manuscript was carried out by D.M., C.T.T, F.N.S, A.N.N

Availability if data and materials:

The data generated from this study are available from the corresponding authors upon reasonable request.

Conflict of interest statement:

Authors have no conflicting interests to declare.

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