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A haematological and biochemical analysis of variability of whole blood across different blood donor groups in Yaoundé, Cameroon: A cross-sectional, descriptive study

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Abstract

Background: Data on blood donor variability in sub-Saharan Africa is scarce, despite whole blood being the primary transfusion product. Donor-related haematological and biochemical differences may impact storage quality and transfusion outcomes.

Objective: The study aimed to identify associations between blood donor characteristics and baseline haemato-biochemical parameters of blood units in the Yaoundé University Teaching Hospital (YUTH).

Methods: A descriptive cross-sectional study was conducted on blood donors of the YUTH between May and August 2023. A structured questionnaire was used to collect socio-demographic, lifestyle and medical information. Blood samples were taken from donors and analysed for haematological and biochemical parameters. Pearson's chi-squared test was applied to determine donor characteristics that affect the baseline hemato-biochemistry of blood units. Statistical significance was set at 0.05.

Results: One hundred and five donors were included; 74 (70.5%) were men, 79 (75.2%) were under 35 years old, and 49 (46%) were students. Hemolysis was higher in smokers (OR: 0.30, CI: 0.01 to 0.60, p-value: 0.001). Alcohol consumers had lower red blood cells (OR: 1.14, CI: 1.04 to 1.25, p-value: 0.02). Abnormally shaped red blood cells were more common in overweight donors (OR: 3.11, CI: 1.20 - 8.10, p-value: 0.02).

Conclusion: Baseline haematobiochemical parameters of whole blood vary due to differences in donor lifestyle and medical background. Information from this study could contribute to blood management in SSA, especially in the elaboration of blood donor education programs and in the adjustment of medical selection criteria.

Keywords: Blood donor variability, hemato-biochemical parameters

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INTRODUCTION

Whole blood (WB) is the most commonly used blood product in sub-Saharan Africa (SSA) [1]. Recently, there has been increasing interest in the disparaging storage efficacy of WB units stored under similar banking conditions [2]. Researchers have observed that inter-individual storage performance is highly variable, depending greatly on certain haematological and biochemical parameters of the blood unit [3]. While storage lesions comprising hematological, biochemical, and immunologic alterations progressively accumulate with increasing shelf-life [4–6], the donor variation effect, defined as inter-donor differences that result in markedly disparate blood product quality despite standardised storage

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conditions and durations [7], accounts for variability in storage performance observed at the point of transfusion [7–9]. In high-income settings, omics studies have identified donor characteristics such as sex, age, uric acid, complement receptor status, and body mass index (BMI) as determinants of blood quality [10-12]. However, in SSA, where the demand for blood is high [13], existing studies on donor variability are scarce. Inadequate resource allocation for transfusion medicine, coupled with competing healthcare priorities, has contributed to the relative neglect of blood-related research in the region [14]. This study, therefore, sought to investigate the variability of haematological and biochemical parameters across diverse blood donor demographics and lifestyles in an SSA context.

In Cameroon, donor selection practices primarily involve screening prospective donors for four communicable diseases (HIV 1 and 2, hepatitis B, hepatitis C and syphilis), with limited attention to medical background checks [14]. However, all potential blood donors are administered a questionnaire prior to donor selection. Responses obtained are used to exclude persons for whom blood donation holds a risk of harm through blood depletion or the subsequent blood recipient through pathogen transmission. Due to constraints in human and material resources, vital signs such as oxygen saturation (SpO2), respiratory frequency (RF), BMI, random blood glucose (RBS), and temperature are rarely assessed before blood donation [15]. Moreover, routine screening for endemic conditions such as malaria and sickle cell trait (SCT) is not mandatory. Currently, the understanding of donor characteristics that impact the baseline haematological and biochemical quality of WB is limited.

This study aimed to describe baseline haematological and biochemical parameters of whole blood units at the Yaoundé University Teaching Hospital (YUTH) and to investigate potential associations with socio-demographics, lifestyle and medical background of donors.

MATERIALS AND METHODS

Study design and sites

This study employed a prospective cross-sectional design involving blood donors and whole blood units received at the YUTH. Data were collected using a systematic, consecutive sampling approach over four months, from May 1 to August 31, 2023. Donors whose blood bags were haemolysed, coagulated, or reactive for any transfusion-transmitted infection (TTI) were excluded.

Pre-donation measurement of vital signs

Prior to blood donation, non-mandatory vital signs, including SpO2, RF, BMI, RBS, and temperature, were assessed, alongside routine measurements of heart rate (HR), mean arterial blood pressure (MABP), and pre-donation capillary haemoglobin level (by the photometric haemocue technic). All vital signs were measured by the same trained research staff. Additionally, information on blood donation frequency and the date of last blood donation was collected.

Post-donation collection of donor lifestyle and medical information

To avoid reporting bias due to the fear of deferral, research questionnaires were administered only after blood donation. Enrolled participants provided socio-demographic data, including age, gender, region of origin, and profession, tobacco/alcohol consumption, and medical history (Presenting symptoms and medication taken). To mitigate recall bias, inquiries were restricted to the week preceding blood donation. Further, questions were open-ended and posed without prejudice so as to prompt a more genuine recollection and unbiased responses.

Lifestyle information

Lifestyle variables assessed included regular physical activity (defined as ≥ 30 minutes of exercise at least three times per week), alcohol consumption (≥ 3 bottles of beer or 14 glasses of wine per week for men; ≥ 1 bottle of beer or 8 glasses of wine per week for women), and tobacco use (any quantity of cigarette smoking). Medical background information included past medical history, reported symptoms, and current or recent medication use.

Blood collection

WB was collected from participants into 450 ml single blood bags containing 63 ml of Citrate phosphate dextrose adenine (CPDA-1) anticoagulant. Following the donation, 4 mL of blood was drawn from the bag tubing, which was already mixed with CPDA-1, into EDTA and dry tubes for laboratory analysis. This approach may introduce pre-analytical variability due to the combined effect of CPDA-1 and additional anticoagulants.The remaining content of the blood bag was processed under the routine standard operating procedures of the YUTH.

Laboratory analysis

Blood in the EDTA tube was used for haematological analyses. A complete blood count was done using an automated cell counter (HumaCount 30 TS, HUMAN Diagnostics Worldwide Co., Ltd., Magdeburg, Germany). This measured white blood cells (WBC), red blood cells (RBC), platelets, haemoglobin (Hb), mean cell haemoglobin (MCH), mean cell volume (MCV) and mean corpuscular haemoglobin concentration (MCHC). Subsequently, rapid haemoglobin-S screening was performed using the Itano haemoglobin solubility test (Anamol Laboratories PVT. LTD., Palghar, India). Finally, peripheral blood smears were prepared, stained according to the May-Grünwald-Giemsa method and examined under a light microscope (OLYMPUS) with 100x objective lens to detect malaria parasites and abnormally shaped red blood cells (aRBCs).

The dry tube was centrifuged at 3000g for five minutes using a tabletop centrifuge (EBA 200S, HETTICH Ltd., Tuttlingen, Germany) to obtain serum for biochemical analysis. Electrolytes (sodium, potassium, and chloride)

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were determined using an electrolyte analyser (GE 300, Genrui Biotech Co., Ltd., Shenzhen, China) and lactate dehydrogenase (LDH) was measured using a semi-automated spectrophotometer (Kenza Max Biochemistry, BIOLABO S.A.S, Les Hautes Rives, France). Serum Hb was quantified with a cell counter (HumaCount 30 TS, HUMAN Diagnostics Worldwide Co., Ltd., Magdeburg, Germany), and baseline haemolysis was calculated using the formula: Haemolysis (%) = [(100 - haematocrit) × (serum Hb (g/dL))] ÷ whole blood Hb (g/dL).

Statistical analysis

Data analysis was conducted using IBM SPSS Statistics for Windows version 23. Frequency tables were generated, and parameters were categorised as normal or abnormal based on reference ranges [17]. Comparative analysis was done with Pearson's chi-square test or Fisher's exact test, where appropriate. Associations between donor characteristics and laboratory findings were made by calculating odds ratios at a 95% confidence interval. Statistical significance was defined as $p < 0.05$.

RESULTS

During the study period, 131 individuals were accepted as blood donors at the YUTH. Eighteen were missed by research staff, three were excluded due to haemolysis, and five were excluded for reacting to one or more TTIs. A total of 105 blood donors were retained for this study. Eighty-four (80%) were voluntary donors, while 21 (20%) were replacement donors. Fifty-three (50.5%) were first-time donors, and 52 (49.5%) were frequent donors. The median last blood donation was 12 months (inter-quartile range 4-24 months), and ten (9.6%) donors had given blood three or more times in the past year.

Of 105 included blood donors, 74 were male (70.5%). Participants' ages ranged from 19 to 58 years, with a mean of 30 (SD 8) years. Forty-eight participants (45.7%) identified as students, while 57 (54.3%) were employed. Of 105 respondents, two-thirds (67.5%) reported regular physical exercise; a third (39%) reported regular alcohol consumption, and four (3.8%) reported smoking.

Table 1. Frequency of normal and abnormal laboratory parameters of whole blood units at baseline.

Variable	Reference Range	Mean (min-max)	Classification	Total (N=105)	Percentage
WBC ($x10^9$/L)	4.0- 10.0	4.53 (2.24-9.50)	Low	41	39.05
			Normal	64	60.95
RBC ($x10^{12}$/L)	3.5-5.5	4.67 (3.01-7.68)	Low	7	6.69
			Normal	88	83.79
			High	10	9.52
Haemoglobin (g/dL)	12.5-18	13.50 (8.00-18.41)	Low	15	14.28
			Normal	88	83.81
			High	2	1.91
MCV(fL)	80-100	83.25 (47.70-94.42)	Low	25	23.81
			Normal	80	76.19
MCH (pg)	27-34	29.0 (16.10-33.90)	Low	23	21.90
			Normal	82	78.14
MCHC (g/dL)	32-36	34.73 (27.32-37.84)	Low	12	11.43
			Normal	76	72.38
			High	17	16.19
Platelet ($x10^9$/L)	150-400	224 (119-391)	Low	7	6.72
			Normal	98	93.34
aRBCs (%/field)	<10	14 (0-30)	Normal	51	48.57
			High	54	51.43
Haemolysis (%)	<0.8	0.01(0.0-0.3)	Normal	105	100
			High	0	0
Sodium (mEq/L)	137-150	140.31 (125.50-159.42)	Low	22	20.95
			Normal	81	79.05
			High	2	1.91
Potassium (mEq/L)	3.4-5.8	3.82 (2.87-6.19)	Low	25	23.73
			Normal	77	73.33
			High	3	2.94
Chloride (mEq/L)	98-109	106.13 (86.01-126.00)	Low	11	10.48
			Normal	74	70.48
			High	20	19.04
LDH (IU/L)	225-450	431.89 (221.04-765.21)	Normal	74	70.49
			High	31	29.52

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Table 2. Comparison between donor characteristics and cell counts of whole blood at baseline

Donor Characteristics	WBC (x10^9/L)		RBC (x10^{12}/L)		PLT (x10^9/L)	
Total (n, %)	<4	4-10	<3.5	3.5-7.5	<150	150-400
	41 (39.0)	64 (61.0)	8 (7.6)	97(92.4)	7(6.7)	98 (93.3)
Age (years)						
18-34 (79,75.2)	26	53	8	71	5	74
35-65 (26,24.8)	15	11	0	26	2	24
OR(CI);p-value	0.36(0.15-0.89);0.03		0.90 (0.84-0.97);0.09		0.81 (0.15-4.45).0.08	
Gender						
Male (74,70.5)	34	40	0	74	7	67
Female (31,29.5)	7	24	8	23	0	31
OR(CI);p-value	2.91 (1.12-7.60); 0.03		1.35(1.10-1.66);0.001		0.91 (0.84-0.98);0.08	
Profession						
Student (49,46.7)	18	31	7	42	3	46
Worker (56,53.3)	23	33	1	55	4	52
OR(CI);p-value	0.83(0.38-1.83);0.65		9.17 (1.09-77.40);0.02		0.85(0.18-3.99);0.83	
Alcohol intake						
Yes(41,39.0)	20	21	0	41	4	37
No(64,61.0)	21	43	8	56	3	61
OR(CI);p-value	1.95(0.87-4.36);0.10		1.14(1.04-1.25);0.02		2.20(0.47-10.37);0.31	
Random blood sugar						
<1.26 g/l (99,94.6)	39	60	8	91	5	94
1.26-2.2 g/l (6, 5.7)	2	4	0	6	2	4
OR(CI);p-value	1.30(0.23-7.44);0.77		0.92(0.87-0.97);0.47		0.11(0.02-0.73);0.007	

Note: n = 105. P-values calculated using Pearson's Chi-squared test and Fisher's exact test where more than 20% of the cell count is less than 5. Bold values indicate statistically significant results.
Abbreviations: MCV, mean cell volume; MCH, mean cell haemoglobin; OR, Odds ratio; CI, confidence interval; VD, Voluntary donor; RD, Replacement donor.

Table 3. Comparison between donor characteristics and red blood cell indices of whole blood at baseline.

Donor characteristics	Red blood cell indices					
	Haemoglobin (g/dL)		MCV (fL)		MCH (pg)	
Total (n, %)	<8-12.5	12.5-19.5	<80	80-100	<27	27-34
	36 (34.3)	69 (65.7)	25 (23.8)	80(76.2)	23(21.9)	82 (78.1)
Age (years)						
18-34 (79,75.2)	28	51	21	58	20	59
35-65 (26,24.8)	8	18	4	22	3	23
OR(CI);p-value	1.2(0.48-3.20);0.66		1.99(0.64-6.46);0.25		2.60(0.70-9.59);0.14	
Gender						
Male (74,70.5)	14	60	17	57	16	58
Female (31,29.5)	22	9	8	23	7	24
OR(CI);p-value	0.10(0.036-0.25);0.001		0.86(0.33-2.26);0.76		0.95(0.35-2.59);0.91	
Profession						
Student (49,46.7)	12	37	10	39	10	39
Worker (56,53.3)	24	32	15	41	13	43
OR(CI);p-value	0.43(0.19-0.99);0.04		0.70(0.28-1.75);0.44		0.85(0.33-2.15);0.73	
Donor type						
VD (84,80.0)	25	59	15	69	15	69
RD (21,20.0)	11	10	10	11	8	13
OR(CI);p-value	0.39(0.15-1.02);0.051		0.24(0.09-0.67);0.004		0.35(0.13-1.00);0.04	
Medication taken						
None(90,85.7)	27	63	21	69	18	72
Yes (15,14.3)	9	6	4	11	5	10
OR (CI);p-value	0.28(0.09-0.88);0.023		0.84(0.24-2.91);1.00		0.50(0.15-1.65);0.25	

Note: n= 105. P-values calculated using Pearson's Chi squared test and Fischer's exact test where more than 20% of cell count is less than 5. Bold values indicate statistically significant results.
Abbreviations: LDH, Lactate dehydrogenase; OR, Odds ratio; CI, confidence interval; VD, Voluntary donor; RD, Replacement donor.

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Table 4. Comparison of donor characteristics and indices of whole blood hemolysis at baseline.

Donor characteristics	Haemolysis indices					
	LDH (IU/L)		Potassium (mEq/L)		Haemolysis (%)	
	225-450	>450	<3.4	3.4-6.2	0	0.1-0.8
Total (n, %)	74(70.5)	31 (29.5)	25 (23.8)	80(76.2)	103(98.1)	2(1.9)
Age (years)						
18-34 (79,75.2)	56	23	19	60	77	28
35-65 (26,24.8)	18	8	6	20	26	20
OR(CI);p-value	1.08(0.41-2.84);0.87		1.0(37-3.01);0.92		0.98(0.94-1.01);0.62	
Gender						
Male (74,70.5)	51	23	18	56	72	7
Female (31,29.5)	23	8	7	24	31	0
OR(CI);p-value	0.77(0.30-1.98);0.59		1.11(0.41-2.98);0.85		0.97(0.94-1.01);0.36	
Profession						
Student (49,46.7)	32	17	10	39	49	0
Worker (56,53.3)	42	14	15	41	54	2
OR(CI);p-value	0.63(0.27-1.46);0.28		0.70(0.28-1.75);0.44		1.04(0.99-1.09);0.18	
Donor type						
VD (84,80.0)	55	29	20	64	84	0
RD (21,20.0)	19	2	5	16	19	2
OR(CI);p-value	0.20(0.04-0.92);0.03		1.00(0.33-3.07);1.00		1.12(0.96-1.27);0.004	
Tobacco intake						
Yes(4,3.8)	3	1	1	3	3	1
No(101,96.2)	71	30	24	77	100	1
OR(CI);p-value	1.27(0.13-12.68);0.84		1.07(0.11-10.76);0.96		0.30(0.01-0.60);0.001	
Alcohol intake						
Yes(41,39.0)	28	13	16	25	40	1
No(64,61.0)	46	18	9	55	63	1
OR(CI);p-value	0.84(0.36-1.98);0.60		3.91(1.52-10.05);0.003		0.64(0.04-10.44);0.75	

Table 5. Comparison between donor characteristics and abnormally shaped red blood cells, sodium and chloride ions of whole blood at baseline

Donor characteristics	aRBCs, Sodium and Chloride					
Total (n, %)	≤10	>10	<137	137-160	86-109	>109
	41 (39.0)	64 (61.0)	22(21.0)	83(79.0)	72(68.6)	33 (31.4)
Age (years)						
18-34 (79,75.2)	35	44	15	64	56	23
35-65 (26,24.8)	6	20	7	19	16	10
OR(CI);p-value	2.65(0.96-7.31);0.05		0.64(0.23-1.79);0.39		1.52(0.60-3.85);0.37	
Gender						
Male (74,70.5)	28	46	18	56	51	23
Female (31,29.5)	13	18	4	27	21	10
OR(CI);p-value	0.84(0.36-1.98);0.70		2.17(0.67-7.04);0.29		1.06(0.43-2.60);0.91	
Profession						
Student (49,46.7)	23	26	11	38	30	19
Worker (56,53.3)	18	38	11	45	42	14
OR(CI);p-value	1.87(0.85-4.13);0.12		1.18(0.46-3.03);0.72		0.53(0.23-1.21);0.13	
Donor type						
VD (84,80.0)	32	52	19	65	53	31
RD (21,20.0)	9	12	3	18	19	2
OR(CI);p-value	0.82(0.31-2.16);0.69		1.75(0.47-6.60);0.55		0.18(0.039-0.83):0.017	
Alcohol intake						
Yes(41,39.0)	16	25	11	30	23	18
No(64,61.0)	25	39	11	53	49	15
OR(CI);p-value	0.99(0.45-2.30);0.99		1.77(0.68-4.56);0.24		0.39(0.17-0.91)0.03	
BMI (kg/m^2)						
18.5-25 kg/m^2 (73,69.5)	34	39	18	55	49	24
>25 kg/m^2 (32,30.5)	7	25	4	28	23	39
OR(CI);p-value	3.11(1.20-8.10);0.02		2.29(0.71-7.42);0.20		0.70(0.32-1.99);0.63	

Note: n= 105. P-values calculated using Pearson's Chi squared test and Fisher's exact test where more than 20% of cell count is less than 5. Abbreviations: aRBC, abnormally shaped red blood cells; OR, Odds ratio; CI, confidence interval; BMI, body mass index; VD, Voluntary donor; RD, Replacement donor.

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Past medical history in decreasing order of frequency included smoking (6.7%), surgery (5.7%), allergies (5.7%), rheumatism (2.9%), sexually transmitted infections (1.9%), depression (1.9%), asthma (1.9%), hypertension (1.9%), and coronavirus infection (1.9%). Forty-six (43.8%) participants reported no symptoms a week to blood donation, and 59 (56.2%) reported symptoms including fatigue (33.3%), heartburn (8.6%), abdominal bloating (9.8%), flu (4.8%) and allergic reactions (1.9%). Fifty (47.6%) participants did not take any medication, and 55 (52.4%) reported taking painkillers (47.6%), antibiotics (4.8%) and flu drugs (2.9%). Upon haemoglobin-S and malaria screening done for the purpose of this study, twelve donors (11.4%) were healthy malaria carriers, and 24 (22.9%) were sickle cell carriers.

The mean values of all haematological and biochemical parameters measured lay within normal ranges, yet certain extremes were observed, notably anaemia, thrombopenia, hyperkalemia and hyperlactatemia. Hemolysis was observed in certain blood units, but none was above the 0.8% permissible limit. Abnormally shaped red blood cells were identified on peripheral blood smears. These included dacrocytes (teardrop-shaped or pear-shaped cells), elliptocytes (cigar-shaped cells), echinocytes (crenated cells with multiple spicules), drepanocytes (elongated or S-shaped cells with pointed ends), schistocytes (fragmented cells with a jagged appearance), codocytes (cells with a bull's-eye appearance), and ovalocytes (egg-shaped cells).

WBCs were lower in older donors and in men. RBCs were higher in men, in workers and in non-alcohol drinkers, while platelets were lower in persons with high blood sugar. Haemoglobin was lower in women, students, and donors who had taken medication. MCV and MCH were lower in replacement donors than in voluntary donors. LDH was higher in replacement donors. Potassium was lower in alcohol consumers, whereas percentage of haemolysis was higher in smokers. Abnormally shaped RBCs were higher in overweight donors, while chloride was lower in replacement donors and alcohol drinkers.

DISCUSSION

In this study, the mean values for all haematological and biochemical parameters lay within normal ranges, but several outliers were identified. This observation corroborates previous research indicating that certain haematological parameters in healthy Cameroonians tend to be lower than typical ranges suggested by haematology analysers [18,19]. The extreme levels of abnormally shaped RBCs, Na, K and LDH noted could impair the storage capacity and compromise transfusion outcomes of whole blood units [5,8,20,21].

During our study period, test strips for rapid haemoglobin meters were sometimes out of stock in the YUTH. In such instances, blood bank staff adopted conjunctival colouration of the blood donor as an alternative indicator of pre-donation haemoglobin. On subsequent full blood count analysis done for the purpose of this study, we found that one donor selected as such had a low haemoglobin level of 8g/dL. This highlights the limitation of conjunctival colouration in predicting haemoglobin levels, particularly in individuals with darker skin tones [22]. In this study, we observed that low WBCs related to male sex and older age, while low RBCs were associated with female sex and a student profession. Recent research has indicated that while the normal range of WBCs is wider in women than in men [23-24], the overall range is comparable between both sexes [25]. Lower RBCs in females are explained by regular blood loss through menstruation [26].

We found low platelet count to be associated with higher RBS. Contrasting findings were made by Bhatta et al., who reported higher platelets in hyperglycemic individuals [27]. Future research should be conducted on a larger sample so as to provide deeper insight into the association between donor blood sugar and platelet count. Based on research conducted in high-income countries, replacement blood donations, often deemed unsafe and unethical, are discouraged by international organisations [28]. However, recent studies in SSA have shown that family donors are equally valid and essential to the blood supply as voluntary donors. Similar to voluntary donations, altruism motivates replacement donations, with many replacement donors subsequently becoming repeat voluntary donors [29]. Moreover, the rates of TTIs are comparable between both donor groups in SSA, and, unlike what is generally assumed, African replacement donors hardly report coercion or pressure to donate [30]. Our study found significantly lower levels of RBC indices in family donors and significantly higher levels of LDH in voluntary donors. This can be explained by the fact that family donors usually step in for their relatives in emergency situations without having prepared themselves nutrition-wise [28]. Larger studies are required to examine the tendency of LDH in voluntary donors and to elucidate the actual differences if any, in transfusion outcomes when using blood from voluntary versus replacement donors.

We observed higher aRBCs in overweight donors compared to healthy weight donors, corroborating findings by Sparrow et al. [32], who reported increased hemolysis in overweight-obese males and attributed this to greater mechanical fragility of RBCs in such donors. In this study, haematological and biochemical parameters of WB were similar between malaria-positive and malaria-negative donors. This contrasts with the findings of Aninanghei et al. [40], who reported lower RBC and higher hemolysis in blood from asymptomatic malaria carriers at baseline. Nevertheless, in our study, as in that of Aninanghei, the permissible haemolysis limit of 0.8% was not observed in any blood unit at baseline. We also did not observe any association between SCT and hemato-biochemical parameters of WB. This differs from the observations of Lee et al. [41], who observed reduced elasticity and increased sphero-echinocytosis of RBCs from SCT donors.

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This could be explained by differences in study methods: our study assessed laboratory parameters at baseline only, while Aninanghei and Lee evaluated these parameters during storage. However, differing donors with malaria and/or SCT are contentious in SSA due to the high prevalence of both conditions and the low blood supply. Nevertheless, to ensure transfusion safety, it may be an option to adjust the shelf life of blood from malaria-positive and SCT donors to a point where non-permissible biological quality degradation does not occur.

In our study, mandatory vital signs lay within normal ranges, while non-mandatory vital signs exhibited extremes. This underscores the potential benefit of expanding the panel of vital signs to screen out blood donors with underlying medical conditions that could impact the quality of blood units. Additionally, during post-donation interviews conducted for this study, blood donors reported to have experienced mild symptoms, such as fatigue, flu and gastric pain, a week before donation. Such donors should have been deferred during the regular selection process of the YUTH. That this did not happen highlights the crucial need for continuous training of blood bank staff on rigorous donor selection methods.

The principal limitation of this study, common to all descriptive investigations, lies in its inability to establish causal relationships. Future research should include a large cohort study with repeated analysis of haematological and biochemical parameters of blood throughout storage. Despite these limitations, this preliminary study in SSA has raised pertinent questions on the variability of haematological and biochemical parameters across diverse blood donor demographics.

Conclusion

The mean haematological and biochemical parameters of blood units were normal, but notable outliers were identified that could accelerate storage degradation and compromise post-transfusion efficacy. Haematological and biochemical parameters were associated with donor lifestyle, medical background, and vital signs, particularly non-mandatory signs such as RF, SPO2 and RBS. Further research is needed to inform donor education initiatives, refine donor selection criteria, and improve blood safety.

DECLARATIONS

Ethical consideration

This study received approval from the ethics committee of the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I (Approval No. 5023/UYI/FMBS/VDRC/DAASR/CSD dated February 6, 2023). Written informed consent was obtained directly from all study participants, none of whom was a minor. Participants presenting with abnormal clinical or laboratory findings were referred to appropriate physicians for further evaluation.

Consent to publish

All authors agreed on the content of the final paper.

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None

Competing Interest

The authors declare no conflict of interest

Author contribution

SYIW, TTC and MFW developed study questions and designs. SYIW and NND administered questionnaires. SYIW and ATP coordinated sample analysis. SYIW, ATP, NND, MM and BA analysed data and drafted the initial manuscript. TTC and MFW edited the manuscript. All authors approved the final manuscript.

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Availability of data

Data is available upon request to the corresponding author

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