Acta Scientific MEDICAL SCIENCES (ISSN: 2582-0931)

Volume 7 Issue 8 August 2023

Research Article

Obstacles to Blood Donation and the Prevalence of Sickle Cell Trait at the Bafoussam Regional Hospital Blood Bank, West - Cameroon

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DOI: 10.31080/ASMS.2023.07.1613

Received: June 21, 2023

Published: July 04, 2023

Abstract

Healthy blood transfusion contributes to saving millions of lives each year, while improving the life expectancy and quality of life of patients with life-threatening diseases and other conditions. The present study aimed to determine the characteristics, attitude of blood donors and the prevalence of sickle cell trait at the Bafoussam Regional Hospital Blood Bank (BRHBB). This was a quantitative descriptive cross-sectional study, conducted over a period of one month and including a total of 185 blood donors received at BSHRB. A structured questionnaire was used to assess the participants' characteristics and attitudes towards blood donation. After measurement of blood pressure, pulse, weight, height and haemoglobin level, a sample of approximately 4 mL of blood was collected and used for blood grouping and haemoglobin electrophoresis assay for sickle cell trait determination. Statistical analysis was performed using SPSS version 25 software. Participants aged between 21 and 39 years were the most represented age group with a frequency of 48.1%. 85.9% of the study population were male. Potential donors reported for high systolic or diastolic blood pressure represented 35.8% of the study population. More than half (55.7%) were overweight or obese. Only 8.1% of blood donations were voluntary. 70.8% of donors had 1 to 3 sexual partners. Rhesus D positive O and A phenotypes were the most frequent with proportions of 53.0% and 23.8% respectively. Sickle cell trait was found in 14.6% of the donor population. There is a need to intensify the education of the population on voluntary blood donation, the retention of replacement family donors and the systematic screening of sickle cell trait before blood donation in all hospital blood banks and blood transfusion centres. This will ensure the availability of more healthy blood products and a safer transfusion in Cameroon.

Keywords: Obstacles; Blood Donation; Sickle Cell Trait

Introduction

Blood transfusion (BT) is an indispensable part of modern health care. It is needed in the management of a wide range of health issues, including anaemia, pregnancy related complications and delivery, severe trauma due to accidents and during surgery. It is regularly used for patients with conditions such as sickle cell disease, thalassemias and haemophilia [1]. Each year, 118.5 million blood donations are recorded worldwide. There are about 5 blood donations per 1000 inhabitants in low-income countries where up to 54% of blood transfusions are administered to children under aged under 5 [2].

Currently in Cameroon, an estimated 400,000 blood bags are needed to treat patients in health facilities each year. For such patients, whole blood or blood products transfusion represent the best therapeutic offer. However, less than 25% of blood needs are met each year, with nearly 95% of replacement donations made by relatives or family members and less than 5% of voluntary, non-remunerated donations [3].

According to the World Health Organization (WHO), voluntary regular unpaid blood donors are the most reliable source of blood because they have fewer blood-borne infections than people who donate blood for payment or to family members in emergency situations [4]. This is one of the multifactorial causes reported by Tagny., *et al.* [5] that compromise blood safety in many sub-Saharan African countries. Diakité., *et al.* [6] highlighted weaknesses in the transfusion system in Bamako, with an insufficient level of knowledge regarding blood transfusion and experience among medical staff. A In addition to these multiple challenges, the thorny issues of transfusion transmissible infections (TTIs) [7-9] and haematological diseases such as sickle cell disease [10-12], are major impediments to healthy and optimal transfusion. Sickle red blood cells are responsible for obstructions in the microcirculation, infarctions in various organs, release of pro-inflammatory molecules, increased expression of adhesion molecules, hypercoagulability, and tissue hypoxia [13].

Transfusion of blood containing haemoglobin S to a sickle cell patient increases the sickle cell pool in the recipient and therefore the risk of vascular occlusions that cause attacks [13]. In Cameroon, the prevalence of sickle cell trait is estimated at 22.3% and 1.7% - 9.0% of cases of homozygous sickle cell disease [14]. A study conducted among unmarried youth in Buea, Cameroon, reviled that only 13.2% of participants knew their haemoglobin genotype [15]. Since carrying the sickle cell trait is most often asymptomatic [16], carriers may unwillingly volunteer to donate blood and thus cause adverse effects on their health and that of the recipient. This calls for a repositioning of the benefit/risk ratio of blood transfusion for better patient safety as advocated by Garraud [17].

The work of the blood transfusion research group has laid a solid foundation and defined the prerequisites for blood safety in various French-speaking African countries [18]. Blood transfusion in Cameroon is still insufficiently organised. This is due to delays in the implementation of the decree promulgated in 2003, organising blood transfusion around a national blood transfusion centre [19]. Thus, it is the hybrid system that integrates certain centralised functions such as transfusion guidelines and the collection of voluntary donors in their hospital system applied in many African countries [20] that prevails in Cameroon. In this perspective, the present study aimed to determine the obstacles to blood donation and the prevalence of sickle cell trait among blood donors at the Bafoussam regional hospital blood bank in order to assess the state of the blood transfusion activity and safety in this reference hospital in the West region of Cameroon.

Materials and Methods

Type and duration of the study

This was a quantitative, descriptive, cross-sectional study, conducted over a period of 30 days, from 05 January to 11 February 2021.

Study site and participants

The study was conducted at the Bafoussam Regional Hospital blood bank (BRHBB). It is a public referral hospital in the West Region of Cameroon. The accidental sampling technique was used to recruit participants during the data collection period. Any potential voluntary blood donor received at BRHBB during the data collection period was included in the study.

Ethical consideration

An authorization for data collection was obtained from the BRH Administrative Authority after reading and approving the research protocol. Free and informed consent was obtained from each participant before inclusion in the study. The study was conducted in accordance with the requirements of the Declaration of Helsinki on Research Involving Human Subjects [21].

Collection of demographic and anthropometric data

A structured questionnaire was used to collect data on participants' characteristics and attitudes. Measurement of blood pressure, pulse, weight, height and haemoglobin level was done by an experienced BRHBB technician. Upon arrival at the blood bank, the donor was told to observe 15 - 20 minutes of rest before the above parameters were taken. Blood pressure measurement and interpretation was done according to the 2017 American College of Cardiology Foundation and American Heart Association guidelines [22]. Body mass index (BMI) was calculated and categorised according to WHO guidelines [23]. Donors were considered anaemic if the haemoglobin level was below 13g/dL for men or below 12g/dL for women [24].

Blood collection and biological analysis

A sample of approximately 4 mL of blood was aseptically collected in a tube containing ethylene diamine tetra acetic acid tri potassium (EDTAK3) from each participant and transported at 2 - 8°C to the Saint Vincent de Paul Hospital in Dschang for blood typing and haemoglobin electrophoresis assay.

Donor blood typing

It was carried out using the opaline plate technique. The Beth-Vincent (globular test) and Simonin-Michon (serum test) methods were used. The globular test was performed using Anti-A, Anti-B, Anti-AB antisera on donor's washed cells. Rh D testing was performed using Anti-D (Lorne Laboratories Ltd, UK). For the serum test, a red blood cell suspension of A and B red blood cells obtained from washed red blood cells of known blood groups (A and B), diluted with physiological saline (0.85% NaCl) and stored at 2 - 8°C for a maximum of three days [25] was used. When there was no agglutination using the Anti-D serum, a confirmation test was performed using a monospecific anti-human globulin (Singapore Biosciences PTE Ltd). Weak rhesus D blood were considered rhesus positive.

Haemoglobin electrophoresis

The NAFSC Reagent and Control Kit (SELEO s.r.l, Italy) was used for qualitative determination of haemoglobin fragments. After centrifugation of the blood tubes, plasma was extracted from the cells. One volume of red blood cells was mixed with nine volumes of physiological saline and centrifuged at 2000 rpm for 5 minutes. The procedure was repeated until a clear, colourless supernatant was obtained. One volume of washed red blood cells was then mixed with three volumes of the lysing solution in another tube and incubated at room temperature to obtain the haemolysate.

The cellulose acetate plate was initially soaked with Tris-glycine EDTA-di-sodium (TGES) buffer (pH 9.2) in a jar and then placed between two blotting papers to remove excess buffer. The two chambers of the electrophoresis vessel previously filled on both sides with TGES to a height of 2 cm. Using an applicator, a volume of each haemolysate and NAFSC control was aligned at the base of the cellulose acetate membrane and then transferred to the migration chamber with both ends dipped in TGES in each chamber. The closed chamber was supplied with a current of 220V and 10mA for 40 minutes. After the power was switched off, the membrane was transferred to a jar containing a solution of ponceau red S (0.2%) for staining for 5 minutes, then decolorized for an additional 5 minutes in a 1:20 diluted citric acid (1M/L). After blotting and drying the membrane at room temperature, the migration pattern of the different haemolysates was read against the NAFSC control.

Data analysis

The data were collected registered in Microsoft Excel 2013 spreadsheet software and then transferred to IBM SPSS version 25.0 (SPSS Inc., Chicago, IL, USA) for cleaning and analysis. Results were expressed in terms of proportions and frequencies. Fisher's exact test was used to compare and evaluate the distribution of the sickle cell trait according to the selected characteristics at a significance level of 5%.

Results and Discussion

The age of the participants ranged from [18 - 61] years with an average of 31.5 ± 10 years. The most represented age group was that of people aged between 21 and 39 years (48.1%). This population of blood donors was largely single individuals (47.0%), male (85.9%) with a University level of education (40.5%). Half (50.8%) of the people received at the Bafoussam Regional Hospital blood bank were people working in small jobs. Anaemia was observed in 1.1% of donors. Potential donors reported for high systolic or diastolic blood pressure represented 35.8% of the study population. The mean systolic blood pressure (127 ± 15 mmHg) was above the reference value. More than half of the blood donors (55.7%) were overweight or obese table 1.

Characteristics	Number (%)
Ages ranges (in Years) (n = 185)	
Mean Age ± SD	31.5 ± 10
18 - 28	89 (48.1)
29 - 39	54 (29.2)
40 - 50	34 (18.4)
50 - 61	8 (4.3)
Gender (n = 185)	
Female	26 (14.1)
Male	159 (85.9)
Marital Status (n = 185)	
Married	74 (40.0)
Single	87 (47.0))
Free union	22 (11.9)
Divorced	2 (1.1)
Academic level (n = 185)	
Uneducated	3 (1.6)
Primary	22 (11.9)
Secondary	85 (45.9)
University	75 (40.5)
Profession (n = 185)	
Government worker	22 (11.9)
Entrepreneurs	18 (9.7)
Casual jobs	94 (50.8)
Students	43 (23.2)
Jobless	8 (4.3)
Haemoglobin level in g/dL (n = 185)	
Mean ± SD	15.4 ± 1.4
Moderate anaemia	2 (1.1)
Non anaemic	183 (98.9)
BMI In Kg/m^2 (n = 185)	
Mean ± SD	26.7 ± 4.5
Normal (18.5 - 24.9)	82 (44.3)
High (>90)	103 (55.7)
Blood pressure in mmHg (n = 95)	
Mean ± SD	127/76 ± 15/11
Normal (90≤SBP≤120 and 60≤DBP≤90)	61 (64.2)
High (SBP>120 and/or DBP>90)	34 (35.8)
Pulse rate in bpm (n = 95)	
Mean ± SD	78 ± 14
Normal (60 - 100)	89 (93.7)
High (>100)	6 (6.3)

Table 1: Socio-demographic and anthropometric characteristics of blood donors.

The frequencies of red blood cells phenotypes A, B, AB and O were 24.3%, 16.8%, 4.3%, and 4.6% respectively. The rhesus positive phenotype represented 97.3% of the total donor population table 2.

Rhesus Phenotype	ABO Phenotype				Total
	A	B	AB	O	
Positive	44 (23.8%)	31 (16.8%)	7 (3.8)	98 (53.0%)	180 (97.3%)
Negative	1 (0.5%)	0 (0.0%)	1 (0.5%)	3 (1.6%)	5 (2.7%)
Total	45 (24.3%)	31 (16.8%)	8 (4.3%)	101 (54.6%)	185 (100%)

Table 2: Erythrocytes Phenotypes of blood donors at the BRHBB.

Table 3 shows that a large proportion of donors (71.9%) had adequate knowledge about TTIs. More than half (58.4%) of the blood donors were first-time donors. 91.9% of blood donations were for replacement. Many of the participants had frequent unprotected sexual intercourse. 70.8% of donors had 1 to 3 sexual partners. Some participants had tattoos and scarification.

Characteristics	Number (%)
Knowledge level on TTIs	
Null	8 (4.3)
Average	44 (23.8)
High	133 (71.9)
History of blood donation	
First time	108 (58.4)
2 - 4 times	60 (32.4)
5 - 10 times	10 (5.4)
10 times and more	7 (3.8)
Delay after the previous donation (in Months)	
N/A	108 (58.4)
< 3	2 (1.1)
3 - 5	27 (14.6)
≥ 6	48 (25.9)
Type of donation	
Voluntary	15 (8.1)
Replacement	170 (91.9)
Date of last medication taken (in days)	
< 3	75 (40.5)
10 - 20	15 (8.1)

> 20	167 (90.3)
Unprotected sexual intercourse	
No	67 (36.2)
Sometimes	49 (26.5)
Frequently	69 (37.3)
Number of current sexual partners	
0	42 (22.7)
1 - 3	131 (70.8)
≥ 4	12 (6.4)
History of STIs	
No	158 (85.4)
Yes	27 (14.6)
Practice of scarification	
No	175 94.6)
Yes	10 (5.4)
Tattoos	
No	183 (98.9)
Yes	2 (1.1)
Total	185 (100)

Table 3: Donors attitudes towards blood transfusion.

As shown in table 4, the prevalence of sickle cell trait among blood donors at the BRHBB was 14.6%. The majority of these donors were blood of group A (20.0%) and Rhesus negative (20.0%). Most of the donors with sickle cell trait (71.4%) had a family history of sickle cell disease (P = 0.000).

Variables	**Haemoglobin genotypes**		**Total**	**P-value**
	AA n (%)	**AS n (%)**		
Blood group				0.437
A	36 (80.0)	9 (20.0)	45	
B	26 (83.9)	5 (16.9)	31	
AB	8 (100)	0 (0.0)	8	
O	88 (87.1)	13 (13.9)	101	
Rhesus				0.729
Positive	154 (85.6)	26 (14.4)	180	
Negative	4 (80.0)	1 (20.0)	5	
Family history of sickle cell disease				
No	57 (87.7)	8 (12.3)	65	0.000
Yes	2 (28.6)	5 (71.4)	7	
Unknown	99 (87.6)	14 (12.4)	113	
Total	158 (85.4)	27 (14.6)	185	

Table 4: Prevalence of sickle cell trait according to blood group, Rhesus, hemoglobin level and family history.

The state of progress towards safe transfusion in several African countries remains far from optimal safety standards [18]. A concretisation of the policies governing blood transfusion in Cameroon would contribute to the positive dynamics necessary for the development of this activity [19]. The median age of blood donors in this study was 31.5 ± 10 years. The majority (48.1%) were between 21 and 39 years old. Tagny., *et al.* [26], reported in a systematic review of studies conducted across Africa that the African blood donor was predominantly young compared to observations in Europe. According to Mandisodza., *et al.* [27], this difference is due to the policy of African blood transfusion programmes that focusses mainly on high school and university students for voluntary blood donation.

Male participants represented 85.9% of the total donor population. Many studies in Africa agree that male donors are preferred to female as blood donor [7,28,29]. A study conducted in seven sub-Saharan African countries showed the highest blood donation participation rate of 30% among women in Côte d'Ivoire [30]. In addition to obstetric factors such as pregnancy and breastfeeding that restrict pregnant and lactating women from donating blood [26], there is a belief in Africa that men are healthier than women [31] and therefore more likely to donate blood.

The population of blood donors at the BRHBB consisted largely of single unmarried people (47.0%), mainly with high school and university level educated individuals (45.9% and 40.5% respectively) and 50.8% of people engaged in casual jobs. Mayomo., *et al.* [7] found in a study conducted in Yaoundé that 81.6% of donors recruited at the blood bank were single, the majority also having secondary (35.3%) and university (38.0%) level of education. This increase in the level of education in the general population and among blood donors in particular would be a major asset to the assimilation and adoption of educational and awareness-raising messages on voluntary blood donation and preventive measures for STIs.

Potential donors reported for high systolic or diastolic blood pressure represented 35.8% of the study population. This result is higher than that of Elsafi [32] who found that 14.6% of donors were deferred for high blood pressure in Saudi Arabia. The mean systolic blood pressure (127 ± 15 mmHg) was also higher than that (123.02 ± 13.23 mmHg) obtained in Kurdistan [33]. Ngongang., *et al.* [34] reported in 2019 a severe hypertension of 28.8% in Cameroon. This calls for action to optimise eligibility for blood donation in Cameroon.

In addition to the average BMI being higher than average, more than half of the blood donors (55.7%) were overweight or obese.

BMI was found to be high in 14% of voluntary blood donors in Nigeria [35]. A study found that high BMI values were associated with increased red cell haemolysis after 42 days of storage [36]. Other studies, however, concluded that higher BMI helps to reduce the occurrence of vagal discomfort [37], post-donation reactions [38], etc. Murphy., *et al*. [39], suggest that blood transfusion centres can play an important role in obesity surveillance and public health interventions.

Blood groups O rhesus positive and A rhesus positive were the most common among blood donors. The rhesus-negative phenotype was less frequent and very rarely found within each group of the ABO system. These results are similar to those obtained in many studies conducted in Africa [40-42]. Knowledge of the frequencies of erythrocyte phenotypes of blood donor is essential for the implementation of blood collection strategies [19].

A large proportion of donors (71.9%) had adequate knowledge of TTIs. This is undoubtedly due to the advent of internet tools that facilitate the dissemination of educational messages on this topic and also to the awareness and screening campaigns on the main viral diseases transmissible by blood transfusion organised in the town of Bafoussam [43]. However, much remains to be done to ensure blood safety at the BRHBB, as 70.8% of donors had 1 to 3 sexual partners. Many donors (37.3%) had frequent unprotected sexual intercourse and very few had tattoos and scarification. All this contributes to increase the residual risk of STIs, especially in the context of high endemicity [5,43,44].

Only 8.1% of blood donations were voluntary and the rest were replacement donations. Also, more than half (58.4%) of blood donors were first-time donors. Retention of family replacement donors would help to match demand and supply, especially of rare blood types [19] and help to supply district hospitals and health centres in the region that require them.

The prevalence of sickle cell trait among blood donors at the BRHBB was 14.6%. Fenomanana., *et al.* [10], Antwi-Baffour., *et al.* [16] and Ansah., *et al.* [45] obtained lower prevalences of 1.17% in Madagascar, 11.3% in Accra and 12.87% in the Ho Municipality in Ghana respectively. In contrast, Salomon., *et al.* [46] found a higher prevalence of 23.6% in the Democratic Republic of Congo. This difference can be explained by the variability of the prevalence of sickle cell disease in African countries. Nevertheless, this result calls for the implementation of systematic sickle cell trait screening of blood donors in all hospital blood banks and blood transfusion centres to come in Cameroon, in order to eliminate any risk of transfusion related complications.

Conclusion

The aim of this study was to determine the obstacles to blood donation and the prevalence of sickle cell trait among blood donors at the Bafoussam regional hospital blood bank. Results reveal shortcomings that are not likely to optimise the blood transfusion activity in West Cameroon. This study places an emphasis on the need to intensify the education of the population on voluntary blood donation, the development of strategies to encourage family replacement blood donors towards a free and voluntary donation. In addition to that, the systematic screening for the sickle cell trait in blood donors in all hospital blood banks and blood transfusion centres to come will considerably increase the availability of healthy blood products and a safer transfusion in Cameroon.

Acknowledgement

Authors are grateful to the administrative authorities of the Bafoussam Regional hospital for approving this study, to the staff of the blood bank and participants for their involvement.

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