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## Plasmodium Parasitaemia Among Blood Donors in Sokoto, North Western Nigeria

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# Statement of the problem

- Malaria is a major public health problem with a significant economic implications in SSA.
- Malaria is the leading cause of morbidity & mortality with 75% of the global clinical malaria infection in SSA.
- In 2009, there were 225 million cases & an estimated 781,000 deaths worldwide.
- Malaria causes low productivity, poverty and slows economic growth in endemic countries.
- Malaria accounts for 40% of public health expenditure & > US\$ 12 billion every year in lost GDP.
- A major setback in most African countries has been the development of drug resistant strains.
- Malaria remains the most complex and overwhelming health problem facing humanity [1]. There are 300 to 500 million cases of malaria and 2 to 3 million deaths per year [2].
- About 3.3 billion people are at risk of malaria, a disease which is endemic in 106 countries and between 655 000 & 1.2 million people die every year from Plasmodium falciparum infection [3].
- The disease is endemic in parts of Asia, Africa, Oceania, and Central and South America [4].
- Women & children < 5 years are more susceptible to malaria during pregnancy and in the puerperium [5-8].
- Nigeria is an endemic country for malaria & one of the ways of reducing the risk of TTM is the screening and deferring donors.
- The risk of TTM in Sokoto is not known & donors are not routinely screened for malaria.
- The aim of this present study was to determine the prevalence of malaria infection among blood donors in Sokoto, North Western Nigeria.

# Study design/study area

- The selected area for this study is Usmanu Danfodiyo University Teaching Hospital (UDUTH) which is located in within Sokoto metropolitan city.
- Sokoto State is located in the extreme Northwest of Nigeria, near the confluence of the Sokoto River and Rima River.
- Annual average temperature of 28.3<sup>o</sup>c (82.9 <sup>o</sup>F). Maximum day time temperatures are for most of the year generally under 40 <sup>o</sup>C (104.0 <sup>o</sup>F).
- The warmest months are February to April when daytime temperatures can exceed 45 <sup>o</sup>C (113.0 <sup>o</sup>F).
- The rainy season is from May to October during which showers are a daily occurrence.
- There are two major seasons, wet and dry which are distinct and are characterized by high and low malarial transmission respectively.
- Report from the 2007 National Population Commission indicated that the State had a population of 3.6 million [10].

# Subjects

- A total of 150 consecutively- recruited blood donors aged 18 to 65 years and mean age  $27.4 \pm 6.6$  years visiting the blood banks in Sokoto North Western Nigeria constituted the subjects for this case study.
- Inclusion criteria include age (18-65), no history of long term medication use, no history of transfusion of blood donation within the last 3 months, willingness to give oral informed consent after counseling, non-menstruating women.
- All consecutively recruited blood donors who did not meet the inclusion criteria were excluded from study
- About 3 milliliters of whole blood were collected using monovette vacutainer syringe into EDTA anticoagulated tube to be used for malarial rapid diagnostic test.
- Thin blood film was used for malaria specification, parasite load determination and for the evaluation of blood picture.

# Method

- The *Onset* Malaria Plasmodium falciparum (Pf) antibody (Ab) Rapid test (CTK Biotech, Inc. USA) was used for malaria testing.
- The test is a double antigen based lateral flow immunochromatographic assay.
- Blood film was made by the Push Wedged method.
- Blood films were stained with Giemsa stain.
- The films were examined at 100 x magnification and scored as negative if no parasite was seen after examining 200 microscopic fields.

## Statistical Analysis

- The data collected was recorded on an Excel spreadsheet .
- Statistical analysis was carried out using a statistical software SPSS Version 18.0 (Chicago Illinois).
- Statistical analysis included descriptive statistics of percentages, mean and bivariate analysis of t- test and chi- square.
- Correlation was compared using linear regression analysis. Differences were considered significant when  $p \leq 0.05$ .

# Results

- A total of 150 consecutively recruited blood donors aged 18 to 65 years and mean  $27.4 \pm 6.6$  years were tested for TTM infection.
- Out of 150 blood donors tested, 133 (88.7%) were male while 17 (11.3%) were female.
- Out of the blood donors tested, 55 (36.7%) were positive for Malaria.
- The prevalence of Malaria was significantly higher among group O donors 35 (64%) followed by group B 11(20%) followed by group A 8(14.6) and group AB 1 (2%).
- The prevalence of malaria was significant higher among male donors 48 (87.3%) compared to female donors 7(12.7%) ( $p=0.001$ ).
- The prevalence of malaria was significantly higher among donors in the 18-28 &59-68 years age group.
- Plasmodium falciparum was responsible for all cases of malaria infection among donors.
- The prevalence of malaria was significantly higher among married subjects; 37(62.3%) compared to single subjects 18(37.7%) ( $p=0.01$ ).
- The prevalence of malaria was significantly higher among farmers 21(38.2%) ( $p=0.01$ ).
- The prevalence of malaria was significantly higher among FRD 50(90.9%) compared to VNRD donors 5(9.1%) ( $p=0.001$ ).

Variable	Number (%) tested	Number (%) malaria positive	p-value
<b>ABO Blood Group</b>			
B	31 (20)	11 (20)	<b>0.01</b>
O	92 (61.3)	35 (64)	
A	24 (16)	8 (14.6)	
AB	3 (2)	1 (2)	
<b>Age Groups</b>			
18-28	102 (68)	14(25.5)	
29-38	39 (26)	3(5.46)	
39-48	7 (4.7)	1(1.82)	
49-58	2 (1.33)	0 (0)	
59-68	0 (0)	14(25.5)	
<b>Marital Status</b>			
Single	57(38)	18(37.7)	<b>0.01</b>
Married	93(62)	37(62.3)	
<b>Donor Type</b>			
Voluntary remunerated	Non- 27	5(9.1)	<b>0.001</b>

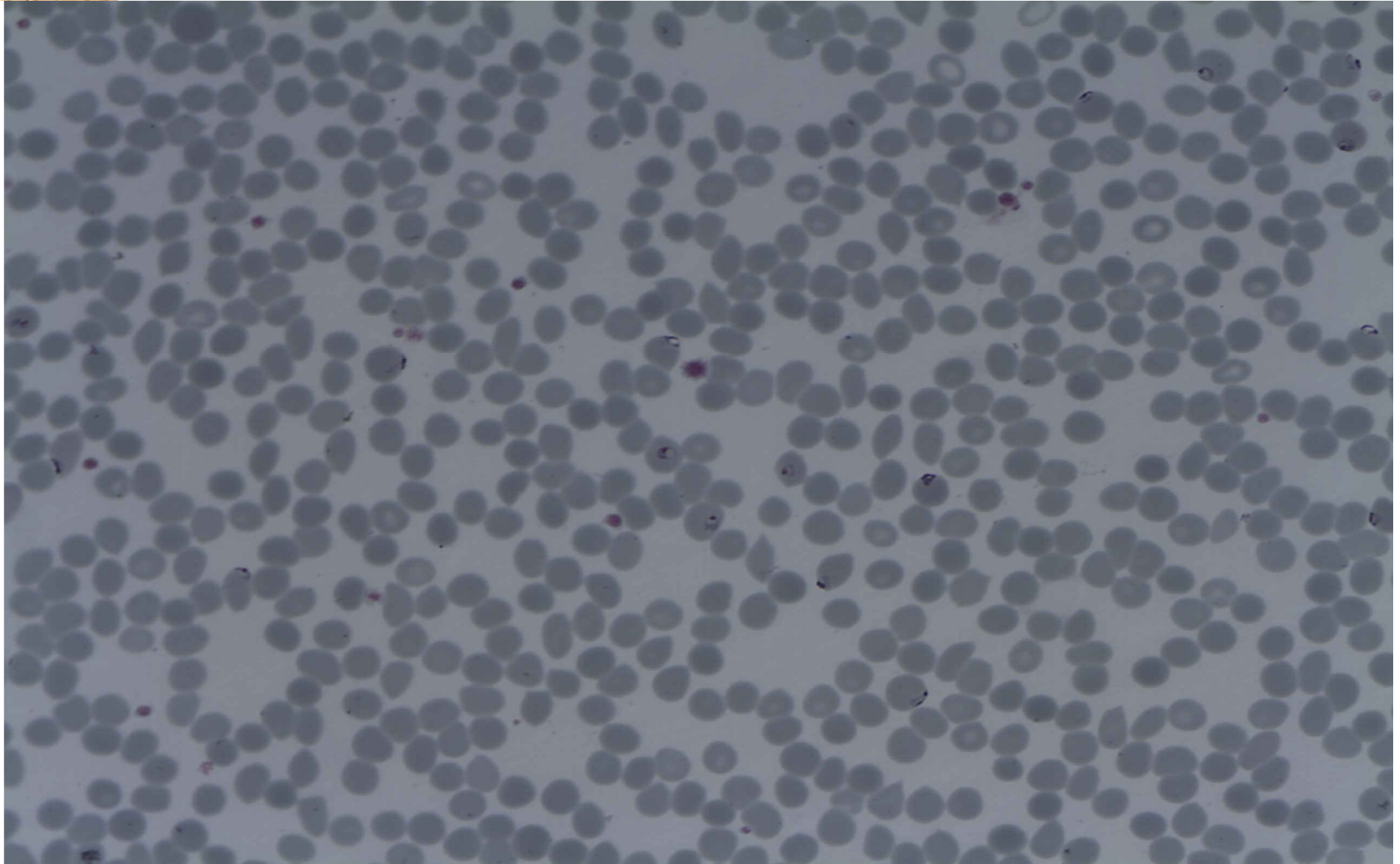


# Result

Occupational groups	Number (%) tested	Number (%) malaria positive	p-value
Farmers	48(32)	21(38.2)	0.01
Traders	24(16)	9(16.4)	
Civil Servants	35(23.3)	14(25.5)	
Students	43(28.7)	11(20)	



**Fig 1: Blood film from one of the subjects showing typical trophozoites of *P. falciparum***



# Discussion

- In this study, we observed a malaria prevalence of 36.7% among our cohort of 150 blood donors in Sokoto, North Western Nigeria.
- Our finding is consistent with results obtained in other parts of Nigeria; 32.5% in the North West of Nigeria [12], 28% and 10.2% respectively observed in Lagos and Port-Harcourt [13-14], 40.9% in South Eastern Nigeria [15], 51.5% in Abakiliki [16], 30.2% in Nnewi, 74.1% in Onitsha [1], 29.4% in Zaria [17], 23.4% in Sokoto and 77.4% in Owerri Imo State, Nigeria.
- The very high prevalence rates recorded by various researchers in the South Eastern part of the country as compared to the 36.7% prevalence obtained in this present study in Sokoto may be largely be due to difference in geographical zone.
- Constant minimum temperatures of 16–18 8C (optimum: 20–30°C) and high humidity for several weeks are pre-conditions for vectoral transmission of malaria [19].
- The vegetation characteristic in the South is that of the tropical rain forest with an average annual rainfall of about 1600mm and a high atmospheric temperature around the year. This provides available surface water and pools for the breeding of the vector.
- Our finding is significantly higher than prevalence of 0.08% and 0.01% observed among blood donors in different parts of India [23-24].
- The high prevalence obtained in this study may be as a result of the fact that this present study was carried out during the raining season which favors the breeding of the mosquito vector which facilitate the spread of malaria infection.
- Other incriminating factors include the rapid rate of urbanization of Sokoto and its attendant sanitation and public health problems.
- Inadequate waste disposal facilities, poor drainage system and poor water supply among many others may also be responsible for the high malaria prevalence obtained in this study.
- Many farmers in the state have undertaken some water-related projects involving the impoundment of drains or streams to create reservoirs for the purposes of irrigating farms. These reservoirs also become breeding grounds of mosquitoes.
-

# Discussion (Cont.)

- The observation of a malaria prevalence of 36.7% among the donors tested has a significant implication particularly among pregnant women and children.
- Recent report advocates that children and pregnant women transfused in the area as well as other malaria endemic regions should receive antimalarial as a prophylactic measure [12]. Transfusion-transmitted malaria (TTM) can have serious consequences.
- Infection with *Plasmodium falciparum* can be rapidly fatal.
- Although international policies and WHO recommend that blood for transfusion should be screened for transfusion-transmitted infections including malaria, screening of donors for malaria is not routinely performed in Sokoto and in most malaria-endemic countries in sub-Saharan Africa.
- Preventive measures aimed at preventing TTM include evaluation of donor medical history and travel history. However, these measures may be not sufficient and reliable to avoid the risk of transmission.
- The cost of a malaria test in the area is significantly lower than the average cost of providing prophylaxis or treatment for malaria. It make economic sense to implement a universal screen program for malaria in Sokoto in particular and Nigeria in general.
- This advocacy is supported by a recent cost effectiveness analysis studies [25- 26] which indicates that pre-transfusion screening is less costly than the recommended Artemisinin-based combination therapy used as prophylaxis in blood transfusion recipients particularly children and pregnant women in some settings. However, a previous report [27] suggest that routine screening for malaria and rejection of malaria-positive donors could considerably jeopardize the blood supply in particularly in SSA where malaria prevalence of > 30% has been reported during the rainy season.
- This can potentially increase morbidity and mortality, especially among pregnant women and children who constitute the predominant pool of patients who require blood transfusion in these settings in SSA [28].
- In this context, it seems that the approach of systematic prophylaxis of all transfusion recipients in SSA with anti-malarials could constitute a good alternative, as it prevents any deferral of donor units as well as the occurrence of TTM.

# Discussion (Cont.)

- A significant relationship exist between age and malaria infection among blood donors in this study. The prevalence of malaria decline across age group in this study with the highest malaria parasite infection occurs in 18-28 years age group and the lowest rate occurs in the Age group 49-58. Our finding is in agreement with report by WHO [29] in sub Saharan Africa including Nigeria communities.
- The prevalence of malaria infection in this finding was higher among the male donors (87.3%) than female donors (12.7%). Our finding is in agreement with a previous report in Nigeria [30-31] and in Brazil [32] who obtained a higher male gender prevalence of malaria among their cohort of blood donors. Our finding is however at variance with a previous report [33] which observed a higher malaria prevalence among Ghanaian female donors compared men.
- The reason for this higher prevalence among male donors could probably be due to greater exposure of male to occupational and nocturnal activities which expose than the females.
- There are a significant relationship in this study between malaria infection and occupation. Farmers were the most affected. A similar affirmative finding was reported in Brazil [32]. Similarly a previous report Mbanugo and colleagues [18] in Owerri, Imo State, Nigeria. High exposure to bite of mosquito among farmer was reported by some scholars to be the major cause of malaria within the study area.
- Farmers are rural dwellers who have no knowledge on the use of control and preventive measure against mosquito bites. Also majority of farmers reside close to their farmland where breeding of mosquito is conducive.
- In this present study we observed a higher malaria prevalence among blood group donors and the lowest prevalence among blood group AB. Our finding is at variance with a previous report in Kaduna which reported a higher malaria prevalence among blood group AB donors [34].

# Discussion

- In this present study we observed a higher malaria prevalence among blood group O donors and the lowest prevalence among blood group AB.
- Our finding is at variance with a previous report in Kaduna which reported a higher malaria prevalence among blood group AB donors [34].
- The majority of donors tested in this study were FRD (90.9%) rather than VNRD (9.1%).
- The amount of VDB has continue to fall over years in Nigeria due to logistic and organizational problem associated with the Nigeria NBTS.
- The net result is that FRD accounted for 90.9%, of malaria among blood donors tested.
- The observation was consistent with the suggestion by WHO which suggest that VNRD are the safest source of blood.
- FRD are more likely to give blood more often than recommended and be more at risk of contracting TTI from high risk behaviours such as multiple sex partners, IVD abuse and unprotected sexual intercourse.
- Our finding is consistent with observation from Eritrea in which TTI's was more prevalent among FRD compared to VNRD [35].

## Discussion (Cont.)

- In this study *Plasmodium falciparum* was responsible for the cases of malaria.
- Human malaria is commonly caused by predominantly 4 species of *Plasmodium*; *P. falciparum*, *P. vivax*, *P. ovale* and *P. malariae* [35].
- Our finding is consistent with previous report which found *P. falciparum* the predominant specie responsible for malaria infection in Nigeria and other African countries [2, 14, 36-37].
- *Plasmodium falciparum* is much more prevalent in sub-Saharan Africa than in many other regions of the world.
- In most SSA countries, over 75% of cases were due to *P. falciparum*, whereas in most other countries outside SSA, other, less virulent *plasmodium* species predominate.

# Conclusion

- This present study indicates a high prevalence of malaria among blood donors studied.
- Collection of blood from CRD and FRD should be discouraged.
- SSA countries need to implement innovative & evidenced –based best practices aimed at recruitment and retention of VNRD.
- It may be justifiable for recipients of blood transfusion particularly neonates, children and pregnant women in our malaria-endemic environment to be routinely treated with antimalarial drugs as a prophylactic measure.
- We advocate for a mandatory universal donor screening policy for malaria, for exclusion of blood donors with plasmodia parasitaemia to further enhance blood safety.



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# References

- [1]. Ekwunife C A, Ozumba NA, Eneanya CI, Nwaorgu OC. Malaria infection among Blood Donors in Onitsha Urban, Southeast Nigeria. *Sierra Leone Journal of Biomedical Research*. 2011; 3(1): 21-26.
- [2]. Enato EF, Mens PF, Okhamafe AO, Okpere EE, Pogoson E, Schallig HD. Plasmodium falciparum malaria in pregnancy: prevalence of peripheral parasitaemia, anaemia and malaria care-seeking behaviour among pregnant women attending two antenatal clinics in Edo State, Nigeria. *Journal of Obstetrics and Gynaecology*. 2009; 29(4): 301-316.
- [3]. World Health Organization. The African Malaria Report. Geneva: WHO/UNICEF, 2003.
- [4]. Nayyar GML, Breman JG, Newton PN, Herrington J Poor-quality antimalarial drugs in Southeast Asia and sub-Saharan Africa. *The Lancet Infectious Diseases*. 2012; 12: 488 – 496.
- [5]. Chima RI, Goodman CA, Mills A. The economic impact of malaria in Africa: a critical review of the evidence. *Health Policy*. 2003; 63(1):17-36.
- [6]. Diagne N, Rogier C, Sokhna CS, Tall A, Fontenille D, Roussilhon C, Spiegel A, Trape J. Increased Susceptibility to Malaria during the Early Postpartum Period. *N Engl J Med*. 2000; 343:598-603.
- [7]. Olanrewaju WI, Johnson AW. Malaria in children in Ilorin, Nigeria. *East Afr Med J*. 2001; 78(3):131-134.
- [8]. Akinbo OF, Omoregie R, Mordi R, Okaka C.E. Prevalence of malaria and anaemia among young children in a Tertiary Hospital in Benin City, Edo State. *Fooyin J Health Sci*. 2009; 1(2):81-84.
- [9]. Anumudu CI, Okafor CMF, Ngwumohaike V, Afolabi KA, Nwuba RI, Nwagwu M. Epidemiological factors that promotes the development of severe malaria anaemia in children in Ibadan. *Afr Health Sci*. 2007; 7(2):80-85.
- [10]. Tapko JP. The road to a safe blood supply in the African region of the WHO: trends and current status: 1999-2006. *Africa Sanguine*. 2007; 10(1):1–6.
- [11]. National Population Commission (NPC). National Census Figures, Abuja, Nigeria. 2007.
- [12]. Isah Zama, Abdulrahman Yakubu, Augustine N. Okwesili, EY Ishaku, Osaro Erhabor, Abdullah S.Mainasara and Kufre E.Uko. Prevalence of malaria parasitaemia and methaemoglobin levels among blood donors in Sokoto, Nigeria. *Internal Medicine Inside* 2013. doi: 10.7243/2052-6954-1-4.
- [13]. Agboola TF, Ajayi MB, Adeleke MA, Gyang PV: Prevalence of malaria parasite among blood donors in Lagos University teaching hospital, Lagos Nigeria. *Annals of Biological Research*. 2010; 1: 72-75.
- [14]. Erhabor O, Ok O, Awah I, Uko KE and Charles AT: The prevalence of Plasmodia parasitaemia among donors in the Niger delta of Nigeria. *Trop Doct*. 2007; 37:32-34.
- [15]. Uneke CJ, Ogbu O and Nwojiji V: Potential risk of induced malaria by blood transfusion in South-eastern Nigeria. *Mcgill J Med*. 2006; 9:8-13.

# References

- [16]. Epidi TT, Nwani CD, Ugorji NP: Prevalence of malaria in blood donors in Abakaliki Metropolis, Nigeria. *Academic Journals*. 2008; 3 (4): 162-164.
- [17]. Oche AO, Aminu M. The prevalence of malarial parasitaemia among blood donors in Ahmadu Bello University Teaching Hospital, Shika, Zaria, Nigeria. *Niger J Med*. 2012; 21(4):445-449.
- [18]. Mbanugo JI, Emenalo S. Prevalence of malaria parasitaemia among blood donors in Owerri, Imo State, Nigeria. *Nigerian Journal of Parasitology* 2004; 25: 75-80.
- [19]. Fritz HK, Kurt AB, Johannes E, Rolf MZ. *Medical Microbiology*, 10<sup>th</sup> edition. Thieme, New York. 2005:520-538.
- [20]. Abdullahi AU, Abubakar T, Adamu AI, et al. Malaria in Sokoto, North Western Nigeria. *African Journal of Biotechnology*. 2009; 8 (24): 7101- 7105.
- [21]. (Okocha EC, Ibeh CC, Ele PU, Ibeh NC. The prevalence of malaria parasitaemia in blood donors in a Nigerian teaching hospital. *J Vector Borne Dis* 2005;42(1):21-24).
- [22]. Negi G, Gupta V, Srivastava V, Gaur DS. Malaria positivity among blood donors: an important index to assess blood safety. *Parasit Dis*. 2014; 38(1):1-3.
- [23]. Chandra T, Rizvi SN, Agarwal D. Decreasing prevalence of transfusion transmitted infection in Indian scenario. *Scientific World Journal*. 2014; 27:173939.
- [24]. Fernandes H, D'souza PF, D'souza PM. Prevalence of transfusion transmitted infections in voluntary and replacement donors. *Indian J Hematol Blood Transfus*. 2010; 26(3):89-91.
- [34]. Ochei J, Malkhathar A. *Medical Laboratory Sciences Textbook*. 2010: 132.
- [35]. Fessehaye N, Naik D, Fessehaye T. Transfusion transmitted infections - a retrospective analysis from the National Blood Transfusion Service in Eritrea. *Pan Afr Med J*. 2011; 9:40.
- [36]. Erhabor O, Adias TC, Hart ML. Effects of falciparum malaria on the indices of anaemia among pregnant women in the Niger Delta of Nigeria. *Clinical Medicine and Research* 2010; 2(3): 035-041.
- [37]. Chikwem, JO, Mohammed I, Okara GC. Prevalence of transmissible-blood infections among blood donors at the University of Maiduguri Teaching Hospital, Maiduguri, Nigeria. *East African Medical Journal*; 1997; 4: 213-216.

# References

- [25]. Rajab JA, Waithaka PM, Orinda DA, Scott CS. Analysis of cost and effectiveness of pre-transfusion screening of donor blood and anti-malarial prophylaxis for recipients. *East Afr Med J.* 2005;12:565–571.
- [26]. Owusu-Ofori AK, Parry C, Bates I. Transfusion-transmitted malaria in countries where malaria is endemic: a review of the literature from sub-Saharan Africa. *Clin Infect Dis.* 2010;51(10):1192-1198.
- [27]. Nansseu JR, Noubiap JJ, Ndoula ST, Zeh AF, Monamele CG. What is the best strategy for the prevention of transfusion-transmitted malaria in sub-Saharan African countries where malaria is endemic? *Malar J.* 2013;12:465.
- [28]. Hassall O, Bates I. Proceedings of blood transfusion research workshop, Mombasa, Kenya 23–25 September 2008. How can research contribute to improving safe blood supplies for emergency transfusions in sub-Saharan Africa? *Africa Sanguine* 2008;11(2):9-14
- [29]. World Health Organization: World malaria report (2003). [http://www.who.int/malaria/world\\_malaria\\_report\\_2003](http://www.who.int/malaria/world_malaria_report_2003).
- [30]. Okocha EC, Oguejiofor OC, Odenigbo CU, Okonkwo UC, Asomugha L. The prevalence of malaria parasitaemia in blood donors in a Nigerian teaching hospital. *Journal of Vector Borne Diseases* 2005; 42(1): 21-24.
- [31]. Uneke CJ. Impact of Placental Plasmodium falciparum Malaria on Pregnancy and Perinatal Outcome in Sub-Saharan Africa. *Yale Journal of Biology and Medicine.* 2007: 95-103.
- [32]. Cerrutti C, Boulos M, Coutinho AF, Hatab LD, Falqueto A, Rezende HR, Duarte AM, Collins W, Malafronte RS. Epidemiology aspects of malaria transmission cycle in the area of very low incidence in Brazil. *Malaria Journal.* 2007; 6:33.
- [33]. Tagny CT, Owusu-Ofori S, Mbanya D, Deneys V. The blood donor in sub-Saharan Africa: a review. *Transfus Med.* 2010;12:1–10.



# Questions



*Merci*

*Many Thanks!*



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