Hematology-2014
OMICS Group Conferences
Accelerating Scientific Discovery
2nd International Conference on
Hematology & Blood Disorders
September 29-October 01, 2014 Baltimore, USA

PREVALENCE OF MALARIA PARASITAEMIA AND METHAEMOGLOBIN LEVELS AMONG BLOOD DONORS IN SOKOTO, NIGERIA

OKWESILI AUGUSTINE NNAEMEZIE

Department of Haematology and Transfusion Medicine, Faculty of Medical Laboratory Science Usmanu Danfodiyo University, Sokoto, Nigeria.

Statement of the problem

- Malaria is one of the world's deadliest diseases affecting people particularly in tropical and sub-tropical regions of the world.
- Malaria remains the most complex and overwhelming health problem facing humanity [1], with 300 to 500 million cases and 2 to 3 million deaths per year [2].
- The disease imposes serious effect on the blood, destroying red blood cells and interfering with the haemoglobin, disrupting the red blood cells pigment and converting haemoglobin to methaemoglobin leading to methaemoglobinaemia
- The safety of blood and blood product is of global concern especially as it concern the TTM infection.
- Haemoglobin taken up by the parasites into their acid food vacuole leads to the spontaneous oxidation of ferrous(Fe^{2+}) to ferric(Fe^{3+}) iron .
- In healthy subjects blood methaemoglobin levels are low , typically <2% of the total haemoglobin in blood.
- Increased concentration of methaemoglobin leads to a methaemoglobinemia which leads to varying complication (skin discoloration cyanosis, weakness, confusion and death).

Objectives

- To screen blood donor for malaria parasite and establish its prevalence among donors in UDUTH.
- To screen blood donor for malaria parasite and establish its prevalence among donors in UDUTH.
- To determine methaemoglobin levels among the malaria infected blood donors.
- To establish the relationship between malaria infection and methaemoglobin levels.
- To relate methaemoglobin concentration with the degree of parasitaemia.

Subjects

- The subjects for this study included 228 consecutively-recruited apparently healthy male blood donors aged 18 – 45 years visiting the Haematology and Blood Transfusion unit for blood donation purposes.
- Only donors who met the inclusion criteria of age and blood donation requirement of haemoglobin (≥12.5g/dl) and those who gave informed consent after counseling were enrolled into the study.

Methodology

- Two hundred and twenty eight (228) consecutively-recruited apparently healthy male blood donors aged 18-45 years were tested for methaemoglobin levels.
- Modified Evelyn and Malloy method was used for methaemoglobin estimation.
- Malaria testing was done using thin films prepared from the EDTA-anticoagulated blood and stained with Giemsa stain.
- The thin film was made by the push wedge technique. Parasite counts were reported per 500 white blood cells (WBC).
- The total parasite count was determined and result expressed as the number of parasites per microlitre of blood.
- The smears were examined using 100x oil immersion. A well-stained area, free of precipitates and well-populated with white blood cells (10-20 WBCs/ field) was selected.
- No Parasite Found (NPF) was reported after 100 fields, each containing approximately 20 WBCs.
- These smears were examined to determine the presence of malaria parasites, calculation of the parasite load and speciation of the malaria parasites. Examination was done using 100 x oil immersion objective.

Statistical Analysis

- Statistical analyses were conducted using SPSS (version 11) software.
- Comparisons between populations were made using the Student's t-test for parametric data and the Mann-Whitney test for non-parametric data.
- An alpha value of < 0.05 denoted a statistically significant difference.
- Correlation was compared using a version of linear regression analysis.

Result

- Out of a total of 228 blood donors screened for malaria 74 of the subjects representing 32.5% were positive for Malaria and 154 representing 67.5% of screened donors tested negative.
- Plasmodium falciparum was responsible for all cases of parasitaemia.
- The mean parasite load among the plasmodium-parasitized donors was 228 ± 99 parasite per microliter of blood.
- Among the malaria-infected donors, 60 (67.5%) had a parasite density of ≤500 µ/L, while 14 (6.2%) had a parasite density of 501 µ /L– 10000 µ/L.
- The mean methaemoglobin concentration was significantly higher among malaria parasitized donors (2.75% and 3.55%) respectively with parasite density of ≤500 µ/L and 501 µ /L– 10000 µ/L compared to non-infected blood donors (2.0%).
- The mean methaemoglobin levels was significantly higher (p=0.002) among malaria infected donors with parasite density of ≤500 µ/L and 501 µ /L– 10000 µ/L (2.75% and 3.55%) compared to non-infected blood donors (2.0%).
- We observed a significant positive correlation between parasite density and methaemoglobin level (r= 0.72, p=0.001).

Table 1: Prevalence of malaria among blood donors

Malaria status	Frequency	% prevalence
Positive	74	32.5
Negative	154	67.5
Total	228	100

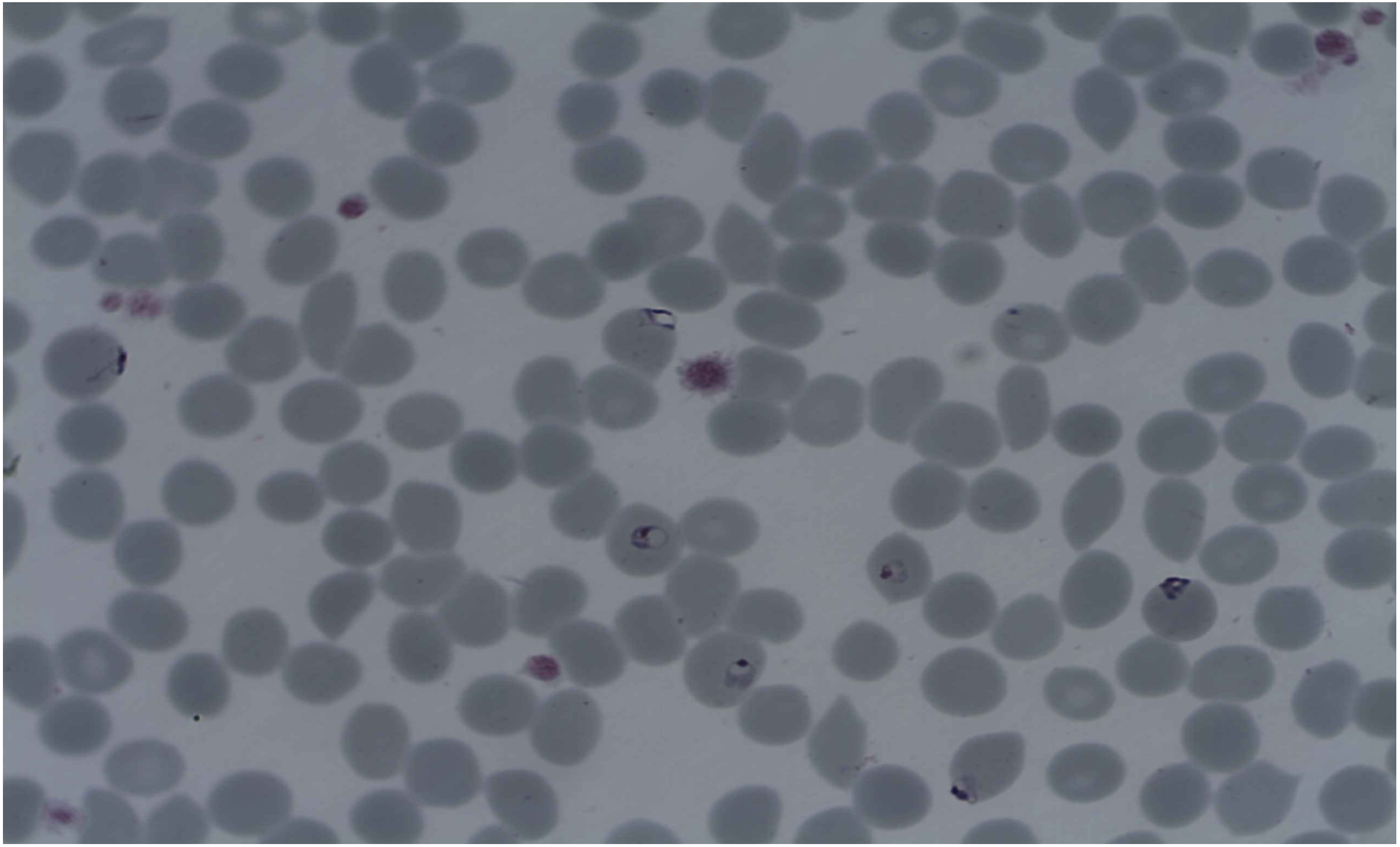
Table 2: Methaemoglobin levels in relation to the degree of Parasitaemia among Blood Donors

Level of parasitaemia	Number of subjects	Methaemoglobin level (%)	P-value
Negative	154	2.0	0.002
≤500µ/L	60	2.75	
501 µ /l – 10000 µ /L	14	3.55	

Table 3.Methaemoglobin levels in relation to degree of parasitaemia among blood donors

Malaria Result	Frequency	Methaemoglobin level (%)	P-value
Negative	78	2.0	<0.05
Positive +	60	2.75	
Positive ++	14	3.55	

Figure 1:Malaria positive Blood film



Discussion

- In this present study, we observed a malaria prevalence of 32.5% among the donors tested.
- Our findings is higher than prevalence of 28%, 10.2% & 23.4% respectively observed by Agboola and co-workers [4] in LUTH and by Erhabor et al in Port Harcourt Nigeria [12] and Abdullahi *et al [16]* in Sokoto .
- Other similar studies carried out around the country including a study carried out in the South East of Nigeria showed a prevalence rate of 40.9% [13]. In Abakaliki metropolis, Epidi et al [14] in their work obtained malaria prevalence of (51.5%) among their blood donors. Similarly Ekwunife [1] reported an alarming high rate (74.1%) of malaria infection among blood donors in Onitsha urban area.
- The very high prevalence rates recorded by various researchers in the South Eastern part of the country as compared to the 32.5% prevalence obtained in this present study in Sokoto may be largely be due to difference in geographical zone.

Discussion

- Consistent with previous reports [17-20], we found P. falciparum the predominant species among plasmodium-parasitized donors.
- Plasmodium falciparum malaria may be associated with a potentially fatal outcome, particularly if there are delays in recognition and treatment [16].
- However, there is increasing advocacy for recipients of blood transfusion particularly neonates, children and pregnant women in malaria-endemic areas to be routinely treated with antimalarial drugs as a prophylactic measure.
- Transfusion malaria was described as particularly common in countries where blood donation has become a commercial transaction and where the blood donors come from less affluent social classes [21].

Discussion

- In this present study, the mean parasite load observed among asymptomatic plasmodium-parasitized donors was 228 ± 99 parasite per microliter of blood.
- The parasite load is much lower than a mean parasite count of 2650 ± 234 parasites/µl observed in a previous study [22] among pregnant women with active/symptomatic case of malaria infection.
- A previous report [8] from Nigeria, which investigated the prevalence of malaria among blood donors, observed that there was no relationship between the presence of malaria parasitaemia and clinical malaria.
- Current measures in the study environment, to prevent transfusion-transmissible malaria depend mainly on donor selection using questionnaires.
- Potential donors are only deferred based on their specific answers during the donor-screening process. A number of recent cases of transfusion malaria have been attributed to failure of the questioning process itself or to an unexpectedly long incubation periods of Plasmodium falciparum.
- There may be need to introduce universal screening of blood donors for malaria particularly in malaria endemic countries.
- However, the argument against universal screening of blood donors for malaria, particularly, in non-endemic countries is that the risk of transfusion-transmitted malaria is minimal and the incidence of malaria in the general population is low.
- Universal screening of donors for malaria, particularly, in high-endemicity regions in sub-Saharan Africa will further enhance blood transfusion safety.
-

Discussion

- In this present study, the concentration of methaemoglobin was significantly higher among plasmodium parasitized compared to non-parasitized donors.
- We observed a significant and positive correlation between the level of parasitaemia and methaemoglobin level among parasitized donors.
- Our finding is consistent with the result obtained by Uko and co-workers [23] among malaria infected children in Calabar which showed that patients with severe malaria parasitaemia had markedly raised methaemoglobin values compared to those with mild/moderate malaria infection.
- Our result in this present study shows that there is relatively high prevalence of malaria infection among blood donors in Sokoto, Nigeria and that the level of methaemoglobin concentration is significantly higher among malaria parasitized compared to non-parasitized donors.

Limitations

- Firstly, convenience sampling was used in the recruitment of subjects. Subjects were consecutively recruited blood donors who met the inclusion criteria of age and informed consent.
- This sampling method may have introduced the possibility of selection bias.
- Secondly, it is possible that seasonal variation may have affected the study findings.
- Previous studies [16, 24-25] indicates that malaria infestation in any population could vary by seasons and is particularly higher during the raining season.

Recommendations

- This present study indicates a high prevalence of malaria among blood donors studied.
- 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 in our environment.

Acknowledgement

- I wish to thank the staff of the Department of Haematology in UDUS and UDUTH for their support and collaboration .
- We also wish to thank all the donors who participated in this study for their collaboration.
- I acknowledge my co-authors; Prof. Uko EK, Prof. Erhabor O, Dr. Mainasara AS, Mr Isah IZ, Mr Yakubu A and Mr. Ishaku EY

USMANU DANFODIYO UNIVERSITY TEACHING HOSPITAL, SOKOTO
Tertiary Health Institution

Hematology-2014
OMICS Group Conferences
Accelerating Scientific Discovery
2nd International Conference on
Hematology & Blood Disorders
September 29-October 01, 2014 Baltimore, USA

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. World Health Organization. The African Malaria Report. Geneva: WHO/UNICEF, 2003.
3. Okonko I O, Soleye FA, Amusan TA, Ogun AA, Udeze AO, Nkang O, Ejembi J, Faleye T OC. (2009). Prevalence of malaria plasmodium in Abeokuta, Nigeria. Malaysian Journal of Microbiology, 2009; 5(2) : 113-118
4. 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 (3) : 72-75
5. Wright RO, Lewander WJ, Woolf AD. Methaemoglobinemia: etiology, pharmacology, and clinical management. *Ann Emerg Med, 1999;* 34: 646- 656.
6. Ash-Bernal R, Wise R, Wright SM. Acquired Methemoglobinemia. A Retrospective Series of 138 Cases at 2 Teaching Hospitals. *Medicine*. 2004; 83: 265-272.
7. Attah EB. Malaria and other Blood Parasites. In: *Human Pathology- A Complete Text for Africa, 2000:* 203-210.
8. Erhabor O, Obunge OK, Awah A, Uko EK, Adias TC. The prevalence of Plasmodia parasitaemia among donors in the Niger delta of Nigeria. Tropical Doctor 2007; 37: 32–34.
9. NPC/FRN. Nigeria Population Commission, Federal Republic of Nigeria. Special FGN. Gazette number 23 on the 2006 Population Census, 2006.
10. MOI. In: Molineaux L, Gramaccia G. (1980). Research on the Epidemiology and Control of Malaria in the Sudan Savannah of West Africa. WHO Geneva, 2008; 311: 12.
11. Magos L. Modification of Evelyn and Malloy's method for the determination of methemoglobin. Ind Med Surg. 1960; 29:593.
12. Erhabor O, Obunge OK, Awah I, Uko EK, Adias TC. The prevalence of plasmodia parasitaemia among donors in the Niger Delta of Nigeria. Tropical Doctor Journal, 2007; 37:32-37.
13. Uneke CJ, Ogbu O, Nwojiji V. Potential risk of induced malaria by blood transfusion in South-eastern Nigeria. Mcgill J Med. 2006 January; 9(1): 8–13.

References

14. Epidi TT, Nwani CD, Ugorji NP. Prevalence of malaria in blood donors in Abakaliki Metropolis, Nigeria. *Academic Journals, 2006;* 3 (4): 162-164.

15. Fritz HK, Kurt AB, Johannes E, Rolf MZ. Medical Microbiology, 10th edition. Thieme, New York. 2005: 520-538.

16. Abdullahi AU, Abubakar T, Adamu AI, et al. Malaria in Sokoto, North Western Nigeria. *African Journal of Biotechnology, 2009;* 8 (24): 7101-7105.

17. Chikwem JO, Mohammed I, Okara GC, Ukwandu NC, Ola TO. Prevalence of transmissible blood infections among blood donors at the University of Maiduguri Teaching Hospital Maiduguri, Nigeria. East Afr Med J 1997; 74:213–16.

18. Erhabor O, Azuonwu O, Frank-Peterside N. Malaria among long distance truck drivers in the Niger Delta of Nigeria. Afr Health Sci. 2012 Jun; 12(2):98-103.

19. Erhabor O, Obunge OK, Awah I, Uko EK, Adias TC. The prevalence of plasmodia parasitaemia among donors in the Niger Delta of Nigeria. Tropical Doctor Journal, 2007; 37:32-37.

20. Erhabor O, Adias TC, Hart ML. Effects of falciparum malaria on the indices of anemia among pregnant women in the Niger Delta of Nigeria. Journal of Clinical Medicine and Research, 2010; 3:035-041.

21. Adewuyi JO. The challenge of blood safety in Africa. Africa Sanguine 2001; 4(2): 1–5. 10.

22. Erhabor O, Adias TC, Hart ML. Effects of falciparum malaria on the indices of anaemia among pregnant women in the Niger Delta of Nigeria. Journal of Clinical Medicine and Research Vol. 2(3) pp. 035-041.

23. Uko EK, Udoka AE, Etukudoh MH. Methaemoglobin profile in malaria infected children in Calabar. *Niger. J. Med, 2007;* 12(2): 94- 97.

24. Carme B, Kenmogne D, Copin N, Mbitsi A. Plasmodium prevalence and parasite burden in blood donors of Brazzaville Congo. Soc Belg Med Trop 1993; 73:179–87.

25. Ibhanesebhor SE, Otobo ES, Ladipo OA. The prevalence of malaria parasitaemia in transfused donor blood in Benin City, Nigeria. Trop Paediator 1996; 16:93–5.

Questions

Many thanks for your attention

Hematology-2014

OMICS Group Conferences
Accelerating Scientific Discovery

2nd International Conference on
Hematology & Blood Disorders

September 29-October 01, 2014 Baltimore, USA