

# Blood transfusion Malaria among Blood Donors in the Central Blood Bank of Kassala State, Sudan

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## Summary

**Background and aims:** Although blood transfusion is generally believed to save human lives, blood can be a vehicle for the transmission of some infectious and parasitic diseases including malaria. So, this study aims to determine the prevalence of blood transfusion malaria among blood donors in the Central Blood Bank of Kassala State, according to age and blood groups.

**Materials and methods:** A cross-sectional study was carried out in the Central Blood Bank in Kassala State among blood donors; this study involved one hundred blood samples, collected from donors aged from 18 to 41 years.

**Results:** The results showed that 1 (1%) of the donors was infected with the malaria parasite. The results also showed that the species of the malaria parasite was *Plasmodium falciparum*; the other Plasmodium species were not found. The results revealed that most donors were blood group O, while AB was the least common blood group; the blood group that harbored the malaria parasite was blood group O, and the other blood groups tested negative. The results also showed the highest number of blood donors was found in the age group of 24-29, and the positive donor was found in the same age group.

**Conclusions:** Both the blood films and immune chromatography test showed one positive result for the donor and the percentage of blood transfusion malaria was 1%.

## Introduction

The term malaria is used for an infection caused by four species of protozoa of the genus Plasmodium, which include *Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium malariae*, *Plasmodium ovale*, and the fifth, *Plasmodium knowlesi* (2). Malaria is one of the most successful parasites ever known to mankind and, after thousands of years, it remains the world's most pervasive infection (6). In tropical Africa, *P. falciparum* and *P. malariae* co-infection is sometimes encountered; *P. ovale* is widespread principally in tropical Africa, whereas *Plasmodium knowlesi* infection occurs only in certain forested areas of South-East Asia (5). According to the World Health Organization, in 2016 there were 216 million estimated cases of malaria in 91

countries, an increase of 5 million cases over 2015, and malaria deaths reached 445000 in 2016, and 446000 in 2015 (15).

The malaria parasite is transmitted from man to man in nature by the bite of certain anopheles mosquitoes, in which it passes an essential part of its life cycle (8). Typical symptoms include fever, chills, sweats, rigors, headache, nausea and vomiting, body aches, and general malaise. These symptoms may be seen in all types of malaria, and the malaria paroxysm is typically accompanied by sudden shaking chills, which may last from 10 to 15 minutes, or longer; during this stage, the patient complains of feeling extremely cold, despite a steady elevation of body temperature (14). In severe cases, patients can have jaundice, kidney failure, anemia, retinal damage, and convulsions (6). The diagnosis of malaria involves the identification of malaria parasites or their antigens or products (9). Blood transfusion therapy is a life-saving procedure and has greatly increased over the years; every second someone in the world needs blood or blood components for surgery, trauma, severe anemia, and complications of pregnancy (3). Although this therapy helps save lives, it is also a vehicle for the transmission of infections, including parasitic diseases (12). Transfusion-transmitted malaria (TTM) was first described in 1911 (10). Unfortunately, the transmission of malaria by blood transfusion is a significant public health problem, especially in malaria-endemic regions (3). So, this study aims to determine the prevalence of malaria among blood donors who come to Kassala Central Blood Bank for donating blood in Kassala State, Sudan.

## Materials and methods

This is a descriptive, cross-sectional, hospital-based study. It was conducted in the Central Blood Bank of Kassala State, and was carried out on 100 blood donors who came to the Central Blood Bank for donating blood; all of them were males and their ages ranged between 18 and 41 years. The donors were categorized according to age groups as follows: 18-23, 24-29, 30-35, 36-41, and the blood groups were categorized as 50 blood group O donors, 17 (A), 25 (B), 8 (AB).

After sample size calculation using the following formula, 5 mL of blood sample were collected from all blood donors in EDTA containers for examination.

Sample size formula:

$$n = z^2 p q / d^2$$

n = sample size

z = the normal standard deviate (z=1.96)

p = the frequency of occurrence of an event

q = 1-p (the frequency of non-occurrence of an event)

d = degree of precision (0.05%)

$$n = 1.96^2 * 1.96 * 0.065 * (1 - 0.065) / 0.05^2 = 93 \text{ samples}$$

But we brought the sample size to 100 samples.

## Methodology and blood examination

A direct parasite infection was demonstrated by thin and thick microscopic examination, and immune chromatography test for Plasmodium antigens.

### Blood films

Thick and thin blood films were made from the blood, allowed to air-dry, and the thin films were fixed in absolute methanol. All films were stained with 10% Giemsa solution for 10 minutes, thereafter washed with clean water, and then left on staining racks to air-dry. All films were viewed under the light microscope at 100× magnification under an oil immersion lens.

### Rapid MAT test

The test kit is ready to use after bringing it to room temperature, port A in the test kit was filled with 5µL of anti-coagulated blood by micropipette, and in port B two drops of buffer solution were put vertically with the help of a plastic dropper. The results were interpreted after 20 minutes.

## Data collection and analysis

The results and data obtained by questionnaire were analyzed using Statistical Package for Social Sciences (SPSS) computer program version 23.

## Results

The results showed that, out of 100 blood donors, only 1 (1%) was infected with the malaria parasite (Table 1).

The results showed that out of 50 blood group O donors, 1 donor (2%) was positive for malaria, while donors from the other blood groups, 17 (A), 25 (B), 8 (AB) were all negative for malaria parasites by the booth methods (Table 2), with statistically insignificant differences rate of p=0.799.

The results also showed that the number of donors examined

**Table 1. Overall prevalence of malaria among blood donors.**

Total N.	N. positive	N. negative	Prevalence (percentage)
100	1	99	1 (1%)

**Table 2. Prevalence among ABO blood groups.**

Blood group	N. examined	N. positive	Prevalence (percentage)
A	17	0	0 (0%)
B	25	0	0 (0%)
AB	8	0	0 (0%)
O	50	1	1 (2%)
Total	100	1	1 (2%)

p value=0.799.

**Table 3. Prevalence of malaria among age groups.**

Age group	N. examined	N. positive	Prevalence (percentage)
18-23	29	0	0 (0%)
24-29	35	1	1 (2.8%)
30-35	20	0	0 (0%)
36-41	16	0	0 (0%)
Total	100	1	1 (2.8%)

p value=0.599.

**Table 4. Prevalence of malaria by different methods.**

Method	N. examined	N. positive	Prevalence (percentage)
Blood films	100	1	1 (1%)
ICT	100	1	1 (1%)

p value=0.751; ICT, immune chromatography test.

for malaria parasites in each age group were 29, 35, 20, 16 for the age groups (18-23), (24-29), (30-35), (36-41) respectively. The positive donor was in the age group 24-29 (Table 3).

These differences in rates were found to be statistically insignificant, with  $p=0.599$ .

All donors were males and all blood samples were tested for the presence of malaria parasites by blood films and rapid test, one donor was positive for *Plasmodium falciparum* by both blood films and ICT, and these differences in techniques were found to be statistically insignificant, with  $p=0.751$  (Table 4).

## Discussion

From the results, it is obvious that blood transfusion-transmitted malaria is a real issue, despite the low prevalence rate of infection. Out of 100 blood donors, only one donor was positive, but it is a critical result. However, our prevalence rate was almost near to the prevalence rate reported by Latha *et al.* (11), 2016, in Guindy, Chennai, Tamilnadu, India (0.4%). On the other hand, our prevalence rate was lower than the prevalence rate reported by Abbas *et al.* (1), 2016, in Wad-Madani, Sudan (3%), Ali *et al.* (4), 2004, in Khartoum, Sudan (6.5%) and Pondei *et al.* (13), 2012, in the Niger Delta region of Nigeria (12.56%).

*Plasmodium falciparum* was the only species of malaria parasite identified in the present study, and this finding is similar to that of Pondei *et al.* (13), 2012, but different from the results obtained by Latha *et al.* (11), 2016, on 250 voluntary blood donors, which found that the species identified was *P. vivax*. All blood donors were males with blood group O (50%) as the most frequent and blood group AB (8%) as the least frequent, and the positive donor was in blood group O. Statistically, there are no significant differences in malaria infection among different blood groups, with  $p=0.799$ , and this result was found to be similar to that reported by Epidi *et al.* (7), 2008.

The predominant age group in this study was 24–29 (35) followed by 18–23 (29), 30–35 (20), and 36–41 (16), while in the study done in Abakaliki, Nigeria by Epidi *et al.*, 2008, the age groups were >25, 26-30, 31-35, 36-40 and <41, containing 105, 63, 13, 0, and 1 blood donors respectively. The positive donor was in the age group 24–29 and the differences in rates were found to be statistically insignificant, with  $p=0.599$  (7). When comparing the

blood films and rapid test for the diagnosis of the malaria parasite, the results showed 1 (1%) positive sample by both techniques, which also showed that there are no statistically significant differences between the methods, with  $p=0.751$ . This result was found to be similar to that reported by Latha *et al.* (11), 2016.

## Conclusions

The malaria parasite has a low prevalence rate among blood donors in the Central Blood Bank of Kassala State 1 (1%). The donor was asymptomatic; this leaves the recipients at the risk for blood transfusion-transmitted malaria infection, even if it was one person.

Most of the blood donors were in the age group 24-29, and the positive donor was in this age group.

Blood films and the rapid test showed the same results in the detection of malaria parasites; 1 (1%) donor was positive by each method.

## References

1. Abbas D, Tasheen S, Alla AD. Prevalence of malaria parasite among Sudanese blood donors - Wad Madani - Gezira State. *World J of Pharm and Medic Research*. 2016;2:157-163.
2. Abioye JOK., Abdullahi DK, Alalade OM, Olokun AL. Incidence of malaria parasite in blood donors at Kwali General Hospital, FCT Abuja. *Journal of Emerging Trends in Engineering and Applied Sciences* 2015;6:212-216.
3. Agboola TF, Ajayi MB, Adeleke MA, and Gyang PV. Prevalence of malaria parasite among blood donors in Lagos University Teaching Hospital, Lagos Nigeria. *Annals of Biological Research* 2010;1:72-75.
4. Ali MSM, Gader AA, Kadaru MY, Mustafa SM. Screening blood donors for malaria parasite in Sudan. *Ethiop J Health Dev*. 2004;18:15.
5. Autino B, Noris A, Russo R, Castelli F. Epidemiology of malaria in endemic areas. *Mediterr J Hematol Infect Dis*. 2021;4:e2012060.
6. Beare NA, Taylor TE, Harding SP, *et al.* Malarial retinopathy:

- a newly established diagnostic sign in severe malaria. *Am J Trop Med. Hyg* 2006;5:790.
7. Epioti TT, Nwani CD, Ugorji NP. Prevalence of malaria in blood donors in Abakaliki Metropolis, Nigeria. *Scientific Research and Essay* 2008;3:162-164.
  8. Fedoric B, Noniod B. Protozoa infection, children in health and disease. 1<sup>st</sup> Edition, Bailliere Tindall, London, UK. 1978;727.
  9. Hanscheid T, Grobusch MP. How useful is PCR in the diagnosis of malaria? *Trends Parasitol* 2002;18:395-398.
  10. Kitchen AD, Chiodini PL. Malaria and blood transfusion. *Intern J of Trans Med* 2006;90:77-84.
  11. Latha B, Hamsavardhini S, Arumugam B. Malaria screening among voluntary blood donors - to find out the prevalence - to evaluate the sensitivity of different techniques. *J of Dent and Med Sciences*. 2016;15:85-88.
  12. Mohareb FA. Transfusion transmitted malaria. *Trans Med* 1995;15:5-8.
  13. Pondei K, Lawani E, Ndiok E. Prevalence of the malaria parasite in screened blood in a tertiary health centre in the malaria-endemic Niger Delta region of Nigeria. *Glob Advan Res J of Micro* 2012;1:188-193.
  14. Satoskar AR, Simon GL, Hotez PJ, and Tsuji M. Medical parasitology. Landes Bioscience, Austin, USA, 2009.
  15. World Health Organization. 2017. World malaria report 2017. Available at: <http://apps.who.int/iris/bitstream/handle/10665/259492/9789241565523-eng.pdf;jsessionid=E31EC15FEF120DF6A636AC15B355F195?sequence=1>.

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