# Magnitude of Malarial Parasite among The Blood Donors from Endemic and Non-Endemic Area of Bangladesh: A Cross Sectional Study

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## Abstract

**Background:** Transfusion transmitted malaria is one of the feared dangers in transfusion services. Parasite density is often quite low in healthy donors to detect the magnitude of plasmodium among the blood donors. To develop awareness about transfusion transmitted malaria and to find out the socio-demographic characteristics of blood donors from endemic and non-endemic areas.

**Materials and methods:** This cross-sectional study was conducted in three Transfusion Medicine Departments of Chattogram, Cox's Bazar and Dhaka District from February 2015 to July 2015. Here, 150 consecutive healthy blood donors were included in two groups equally (Group I endemic and Group II non-endemic). Malaria screening was done by rapid diagnostic method.

**Results:** Most of the participants were in 21-30 years age group, 44(58.7%) and 45(60.0%) in group I and group II respectively. Male to female ratio was 11.5:1 (Male 69 and female 6). Again, 50(66.7%) in group I and 67(89.3%) in group II came from urban area. Previous history of fever (Within 3 months) was found 18(24.0%) in group I and 6(8.0%) in group II. Malarial parasite was detected 1(1.3%) in group I but none in group II ($p>0.05$, non-significant).

**Conclusion:** This work will be helpful in improving preventive strategies for secure blood transfusions.

**Key words:** Blood transfusion; Malaria parasite; Screening.

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## Introduction

Blood safety is a serious concern on a worldwide scale in transfusion medicine, especially in underdeveloped nations where there are insufficient or ineffective national blood transfusion rules, services and financial resources.[1] Blood transfusions are linked with a variety of problems, some of which are minor while others might be fatal, necessitating rigorous pretransfusion testing and screening, especially for transfusion transmissible diseases, such as malaria.[2] Transfusion-Transmitted Malaria (TTM) cases are frequently reported worldwide for a long period of time. Even a tiny number of infected red blood cell can cause transmission of the disease in the receiver.[3]

Malaria be transferred through the bite of afemale anopheles mosquito, contaminated needle, transfusion, transplantation or through placental defect. TTM can be caused by injection of asexual trophozoites. In trophozoite-induced malaria the pre-erythrocytic schizogony is absent, short incubation period,exo-erythrocytic schizogony is not present, relapses do not occur, and radical cure is possible.[4] Common species that causes malaria in humans are P. falciparum and P. vivax.

Considering morbidity and mortality, malaria is one of the most prevalent diseases all over the world.[5] WHO estimates more than 198 million cases of malaria globally in 2013 which led 584,000 deaths in 106 countries. Around 3.3 billion people were infected with malaria and 1.2 billion are at high riskaround the globe.[6] India reports around 1 million malaria cases annually, among them p. falciparum and p. vivax are the most common species (>50%) causing malaria.

P. vivax is more prevalent inlowlands while p. falciparum predominates in forested and hilly areas.From 2008 to 2013, malaria incidence has decreased from 84,690 to 26,891 and death rate dropped from 154 to 15 (National surveillance data). Malaria is endemic in 13 eastern and

northeastern border belt districts of Bangladesh. Morethan 80% cases are reported from hill tract districts of Chittagong (Rangamati, Khagrachari & Bandorban).[7,8,9] Around 13.25 million people are at risk of malaria inhabited in those districts. Malaria continues to be the most prevalent transfusion transmitted illnesses worldwide, even though a variety of other pathogens have been documented to be spread through blood transfusion. Even a tiny number of red cells, platelet and granulocyte concentrates, fresh frozen plasma and cryoprecipitate can transmit malaria during transfusion.[10,11]

In Bangladesh, screening given blood for TTIs has entered a new age ever since the safe blood transfusion program was established. In endemic areas, laboratory-based screening should be combined with criteria for donor selection and deferral depending on the season, location, etc. Specific antibody detection is useful for screening of high risk doners from non-endemic regions.[12]

Plasmodium species can persist for several years in donors. Transfusion transmitted malaria is prevalent due to some following facts that i) Semi-immune people with low parasitemia levels may donate blood during symptom free period which may be a serious problem in endemic zones ii) Malarial parasite can survive at $4^0$C iii) Sensitivity of recently available malaria screening techniques (Rapid diagnostic test 100 parasites/L) is much lower than that required to detect levels of parasitemia which may cause TTM ( 0.0004 parasites per liter or 1-10 parasites per unit of blood).[13]

A chance of 1-2 per 1000 recipients obtaining blood tainted with bacterial, viral, or parasite organisms exists.[14] In countries like USA and Canada where malaria is non endemic the incidence is very low but in endemic countries, the rate of transmission may be as high as 50 cases per donation, so transmission of malaria by blood transfusion poses a real threat in endemic zones.[10] Malaria parasite was identified in roughly 0.03%, 0.33%, and 0.57% of blood donors from India, Nepal, and Pakistan, respectively.[15,16] Malaria was identified about 0.09% of blood donors in an endemic area of Bangladesh in a study (Highest in Africa around 33%).[17]This study will be helpful in developing prevention policy for safe blood transfusion. This studyalso helps to assess the magnitude of p. falciparum and p. vivax among donors from endemic and non-endemic area to highlight the potential risk associated with induced malaria by blood transfusion.

**Materials and methods**

This cross sectional study was conducted at Transfusion medicine departments of Chittagong Medical College Hospital, District Sadar Hospital, Cox's Bazar and Bangabandhu Sheikh Mujib Medical University, Dhaka during the period from February to July 2015.

*Inclusion criteria*

Individualswith good health and not having any recent serious illness. Hb > 12 gm/dl, Weight>50 kg, Temp < 99 F, Pulse 60-100 beat/min and Systolic BP within 100-200 mm of Hg and Diastolic BP within 60-100 mm of Hg.

*Exclusion criteria*

Donor with history of blood transfusion within 6 months, recent surgery, acupuncture, tattoo, ear, or body piercing were excluded from the study.

All participants undergone a preliminary assessment that includes complete history, physical examination, and relevant laboratory tests. After taking informed written consent from the doner a semi structured questionnaire form was filled during a short interview. There were two groups in this study labelling Group I= Endemic region (Chattogram and Cox's Bazar) and Group II= Non endemic region (BSMMU, Dhaka).

Selection of 150 donors was done consecutively. They were categorized in two groups. Continuous variables were statistically expressed by mean and Standard Deviation (SD). Qualitative and quantitative data were described in orders, numbers and percentages. Statistical significance was defined as $p < 0.05$ with 95% confidence interval. The whole analysis was done with SPSS -20 version.

Ethical approval was given by Institutional Review Board of BSMMU (No. BSMMU/2015/ 10388, Date: 12/08/15).

## Results

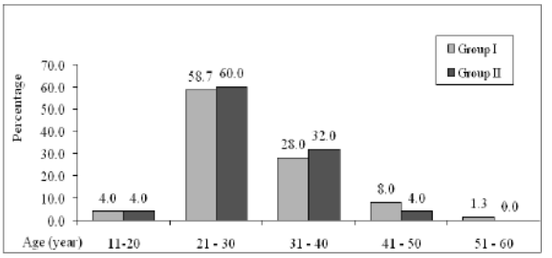


**Figure 1** Bar diagram shows age distribution of the study subjects

It was observed that majority subjects belonged to age 21-30 years in both I and II groups. Mean age was 29.75±7.64 years in group I and 28.55±5.68 years in group II. This difference was statistically non-significant (p>0.05).

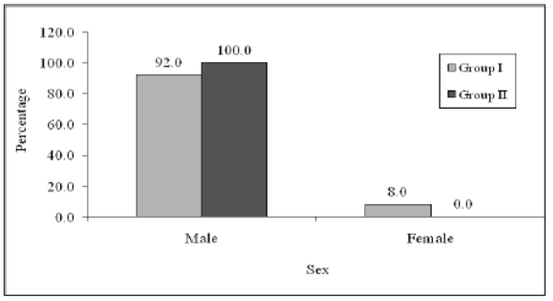


**Figure 2** Bar diagram shows sex distribution of the study subjects

Regarding sex distribution of the subjects, it was observed that male participation was predominant in both groups, which was 69(92.0%) in group I and 75(100.0%) in group II. The difference was statistically significant (p<0.05) between two groups.

**Table I** Distribution of the study subjects by socio demographic variable (n=150)

| Socio demographic variables | Group I (n= 75) | | Group II (n= 75) | | p- value |
|---|---|---|---|---|---|
| | n | % | n | % | |
| Residence | | | | | |
| Rural | 25 | 33.3 | 8 | 10.7 | 0.002[s] |
| Urban | 50 | 66.7 | 67 | 89.3 | |
| Occupational status | | | | | |
| Service | 27 | 36.0 | 26 | 34.7 | |
| Student | 27 | 36.0 | 25 | 33.3 | 0.158[ns] |
| Housewife | 0 | 0.0 | 5 | 6.7 | |
| Others | 21 | 28.0 | 19 | 25.3 | |

s= significant, ns=not significant.
p- value reached from chi square test.

Majority 50(66.7%) of subjects in group I and group II,67(89.3%) came from urban area, which was statistically significant (p<0.05) between two groups. Service holder was found 27(36.0%) in group I and 26(34.7%) in group II. The difference was not statistically significant (p>0.05) between two groups.

**Table II** Distribution of the study of subjects by H/O fever, type of fever and H/O travel to hill tracts or abroad (n = 150)

| Variables | Group I ( n = 75) | | Group II ( n = 75) | | p value |
|---|---|---|---|---|---|
| | n | % | n | % | |
| H/O fever (Within 3 months) | | | | | |
| Yes | 18 | 24.0 | 6 | 8.0 | 0.008[s] |
| No | 57 | 76.0 | 69 | 92.0 | |
| Type of fever | | | | | |
| Continuous | 6 | 8.0 | 1 | 1.3 | |
| Remittent | 4 | 5.3 | 3 | 4.0 | |
| Intermittent | 8 | 10.7 | 2 | 2.7 | |
| H/O travel to hill tracts or abroad | | | | | |
| Yes | 6 | 8.0 | 2 | 2.7 | 0.137[ns] |
| No | 69 | 92.0 | 73 | 97.3 | |

Table II shows H/O fever, type of fever and H/O travel to hill-tracts or abroad of the subjects. It was observed that history of fever (Within 3 months) was found 18(24.0%) in group I and 6(8.0%) in group II. Majority 8(10.7%) subjects had intermittent fever group I and 3(4.0%) had remittent fever in group II. H/O travel to hill-tracts or abroad was found 6(8.0%) in group I and 2(2.7%) in group II. History of fever (within 3 months) was statistically significant (p<0.05) between two groups.

**Table III** Distribution of the study subjects by biochemical investigations (n=150)

| Biochemical investigations of donors Malaria parasite | Group I (n=75) | | Group II (n=75) | | p-value |
|---|---|---|---|---|---|
| | n | % | n | % | |
| Positive | 1 | 1.3 | 0 | 0.0 | 0.005[ns] |
| Negative | 74 | 98.7 | 75 | 100.0 | |

ns =not significant.
p value reached from chi square test.

Table III shows biochemical investigations of donors. Malaria parasite (Plasmodium falciparum and plasmodium vivax) was found 1(1.3%) in group I but not found in group II. The difference was not statistically significant (p>0.05) between two groups.

**Discussion**

During study period malaria testing was carried out using a fast diagnostic approach (ICT). Blood donors from Chittagong and Cox's Bazar were labeled as endemic regions (n=75) and classified in group I anddonors from Dhaka represented non-endemic regions (n=75) classified in group II. The mean age of donors in this study was 29.75±7.64 years varied from 19-56 years in the group I and 28.55±5.68 years in groups II. In our country, Hoque et al. obtained that considering eligible age of being blood donor 18 year, 6.0% were of age group < 21 year, 36.0%. were of age group 21-30 years, 48.0% were of age group 31-40, 14.0% were of age group 41-50 and 2.0% were of age group > 50 years.[18] The mean age was almost similar between two groups, but majority subjects were in 3rd decade in both groups. Chinyelu et al. and Okocha et al. observed the mean age of the donors was 31.45 ± 8.65years and 32.50 ± 8.75 years, respectively which had similarity with this current study.[1,19]

Males predominated in both groups in this study, with 69 (92.0 %) in group I and 75 (100.0 %) in group II. In group II, male was considerably ($p<0.05$) higher. Likewise, Hoque et al. found that 76 % of blood donors were menand 24.0% were women, which is similar to this current study.[18] Aziz et al. found that male donors accounted for 27722 (82.62 %) while female donors accounted for 5831 in Bangladeshi research (17.38 %).[16] Similarly, Sethi et al. discovered that the bulk of the donors (95.48%) were men.[20]

In this study, 66.7% individuals in group I and 89.3% of the subjects in group II hailed from metropolitan areas. In group II, the proportion of donors who came from a city was substantially greater (p 0.05). Around 36.0 % of service holders were in group I, and 34.7 % in group II. Traders had the greatest infection rate, according to Chinyelu et al.[1] In this study, there was no statistically significant difference in infection rates amongst the various occupational categories. This demonstrates that the illness is prevalent and a concern in this region. TTM is usually spread by asymptomatic carriers. Because apparently healthy people are chosen for blood donation, parasite density is generally relatively low, and parasites can be readily overlooked.[17] Inthis study, it was observed that 18 (24.0 %) of the participants in group I had a history of fever during the previous three months, while only 6 (8.0%) of the participants in group II had a history of fever within the previous three months. Most of the participants (8.7%) had intermittent fever in group I, whereas 3 (4.0%) had remittent fever in group II. H/O travel to hill-tracts or overseas was recorded in groups I and II, with 6 (8.0%) and 2 (2.7%) respectively. Fever history (Within 3 months) was substantially greater ($p<0.05$) in group I. According to Dubey et al. 159 (16.9%) of eligible donors were anti-malaria antibody positive, compared to 22.0% of postponed donors with a history of fever, albeit this difference was not statistically significant. The statistically insignificantly higher seroprevalence of malaria antibody in donors with a recent history of fever (22.0%) compared to normal donors (16.9%) does not provide enough evidence to prove or disprove the utility of such criteria at this time, and the findings need to be confirmed in a larger sample size study to avoid unnecessary donor deferrals.[21]

Malaria parasite was found in 1.3 % of the people in group I, but absent in group II, according to this study. The difference between the two groups was not statistically significant ($p>0.05$). Blood samples from 762 volunteers from endemic and non-endemic malaria locations were examined by Contreras et.al.[17] In the endemic states they analyzed, antibody seroprevalence ranged from 1-3.6%, demonstrating that there is some danger of this sort of transmission. 10,615 blood donor samples from eight blood banks in France were examined using the ELISA malaria antibody test, which identifies IgG and IgM antibodies specific to P. vivax and P. falciparum. The findings reflected positive rates from 1.83 to 4.39%.[11] These findings were consistent with a study of 1,756 blood donor samples from endemic and non-endemic regions of Saudi Arabia, where an ELISA analysis revealed a 9.1% antibody-positive rate and 0.18% antigen prevalence for the samples from the endemic region. 4.8% antibody and 0.15% antigen positive frequencies were discovered in the non-endemic area. [21]

Hoque et al. observed 400 blood donors in Bangladesh, and malaria parasites were found in three (0.76%) donors after blood film screening.[18]

In our country a study conducted by Aziz et al. showed malaria in 31(0.09%) male donors.[16] PBF examination found malarial parasites in 100 (100.0%) patients' samples with a parasite load more than 0.01%. According to the monitoring report on Safe Blood Transfusion Programme (SBTP),malaria parasites found 0.03% among the voluntary blood donors. [22] However, the current study had a limited sample size, the frequency of malaria parasites was greater than in the previous investigations.

**Limitations**

- Smaller sample size
- Only single RDT for malaria antigen is used as diagnostic tool.
- The study population was selected from three different hospitals which may not represent the whole country.

**Conclusion**

Most transfusion-transmitted malaria cases are caused by asymptomatic carriers.Therefore, a key focus for preventing unwanted plasmodium spread in both endemic and non-endemic areas is the blood transfusion center. Repeated testing & blood film study may be needed to confirm the malaria parasite among the blood donors of endemic area.

**Recommendations**

- More specific donor questioning, consideration of seasonal variation and geographical variation may help to identify the population of donors who are most likely to be infected.
- To avoid TTM in high-risk groups, administration of antimalarial drugs to transfusion recipient should be taken into consideration.

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**Contribution of authors**

TTC-Conception, design, acquisition of data, drafting, critical revision & final approval.
MS-Manuscript writing, data analysis, critical revision & final approval.
NK-Data interpretation, analysis, critical revision & final approval.
JB-Conception, critical revision & final approval.
FP-Design, data interpretation, critical revision & final approval.
BN-Data interpretation, analysis, critical revision & final approval.

**Disclosure**

The authors declared no competing interest.

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