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# Prevalance and Association of Malaria with the Blood Groupon Febrile Patients

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**Abstract**

**Introduction:** Malaria continues to be a significant global health concern, especially in tropical regions where it remains a major cause of morbidity and mortality. The identification of risk factors for malaria remains critical to understanding its epidemiology and improving control strategies. This study examines the prevalence of malaria among febrile patients and its potential association with blood group types. Investigating this relationship could provide important insights into how blood group may influence the susceptibility to malaria and help improve targeted malaria control interventions.

**Objective:** The primary objective of this study is to assess the prevalence of malaria among febrile patients and to analyze the potential association between blood group type and malaria infection.

**Methodology:** A total of 285 febrile patients were enrolled in the study. Blood samples were collected for malaria parasite detection using thick and thin blood smears, while blood group typing was performed using standard agglutination tests. Descriptive statistics, chi-square tests, and multivariate regression were applied for data analysis.

**Results:** The study found an overall malaria prevalence of 42% among febrile patients. The prevalence was highest among those with blood group O (45%), followed by blood group A (30%), blood group B (20%), and blood group AB (5%). A statistically significant association between blood group O and increased malaria prevalence was observed ($p < 0.05$).

**Conclusion:** The study highlights a significant association between blood group O and a higher malaria prevalence, suggesting that blood group may be a risk factor for malaria infection. Further research into the immune mechanisms underlying this association is necessary for better understanding and targeting malaria prevention efforts.

**Keywords:** Malaria, Blood group, Febrile patients, Prevalence, Blood group O, Infection.

## Introduction

People in tropical and subtropical areas face a significant health challenge from malaria because this infectious disease remains one of the main factors that causes sickness and death [1]. The blood-borne Plasmodium parasites spread from infected Anopheles mosquitoes lead to the development of this disease in humans. The World Health Organization reports that 229 million people experienced malaria infections while 409,000 people died from the illness worldwide in 2019 [2]. Among the Plasmodium species the dangerous and fatal malaria-forming parasite is Plasmodium falciparum yet Plasmodium vivax, Plasmodium ovale, and Plasmodium malariae cause malaria without fatal outcomes. Patients with malaria experience symptoms that match other infectious diseases such as fever together with chills along with headache and sweats which complicates their diagnosis and treatment management specifically in areas with heightened febrile illness rates [3].

The risk factors for malaria development consist of genetic elements together with environmental elements that affect how likely someone is to experience the disease. Research suggests blood group stands out as a significant factor to understand malaria as a disease. Research demonstrates that blood type O provides partial resistance against severe malaria diseases caused by Plasmodium falciparum parasites. Scientists believe the safeguarding mechanism originates from changed interactions between red blood cells and Plasmodium parasites. Scientists propose that red blood cell O antigens do not enable parasite adhesion at the same level as other non-O blood group antigens thereby lowering infection opportunities [4]. People with non-O blood groups especially blood group A appear more susceptible to malaria due to their blood cells better adhering to parasites [5]. Different studies that analyze the connection between blood group types and malaria resistance in various populations do not produce uniform outcomes. Researchers have shown through studies that blood group O positively affects malaria resistance but other studies suggest no connection exists [6]. Scientific consensus supports the theory that blood group directly affects how the body reacts to malaria infections and may change the seriousness of the associated medical condition. Certain blood types cause variations in a person's immune response to malaria parasites leading to consequences for how quickly parasites disappear and affecting malaria treatment success and resistance to malaria infections.

Clinical diagnosis of malaria remains difficult for doctors who treat febrile patients particularly in locations with high malaria risks because several illnesses produce similar fever symptoms [7]. Getting prompt correct malaria diagnosis proves fundamental to decrease mortality rates and medical complications mainly affecting children under five years [8]. The identification of malaria through microscopy and rapid diagnostic tests (RDTs) and polymerase chain reaction (PCR) has become more effective yet ongoing diagnostic difficulties persist especially among low-resource locations demanding immediate correct identification and proper treatment of suspected cases. Blood group testing happens frequently in patient examinations when health professionals evaluate patients with fever-related symptoms [9]. The knowledge of blood group effects on malaria vulnerability would help medical providers develop customized health strategies while identifying specific groups that require preventative measures like chemoprophylaxis. Research suggests that individuals with blood group O have an increased threat of malaria exposure in endemic areas yet additional research about blood O's immune protection needs to be performed [10].

This study makes an assessment of malaria occurrence in fever patients while examining possible links between patient blood groups and malaria susceptibility. The aim of this investigation is to determine how blood type shapes malaria prevalence statistics among febrile patients while assessing the elevated risk of malaria infection among blood group O participants. The study investigates both age along with gender and geographical areas among febrile patients to estimate total malaria exposure rates. Better comprehension of blood group susceptibility to malaria could help enhance malaria control strategies in high-transmission areas because it enables effective prevention method targeting. Knowledge about the blood group O connection to malaria risk enables scientists to create improved treatments and prevention methods which specifically target populations having elevated risk based on their blood type.

**Objective**

The objective of this research is to assess the prevalence of malaria among febrile patients and explore the association between blood group types and malaria susceptibility.

**Methodology**

This was a prospective cohort study conducted over a specified period. 285 febrile patients were enrolled, aged 1 year and above, presenting to a healthcare facility. Patients were selected based on the following inclusion and exclusion criteria:

**Inclusion Criteria:**

- Patients aged 1 year and above presenting with fever (body temperature $\geq 38°C$).
- Informed consent obtained from patients or their guardians.

**Exclusion Criteria:**

- Patients who had previous malaria treatment within the past 2 weeks.
- Individuals with severe comorbidities such as immunocompromised conditions (e.g., HIV, cancer) or chronic diseases.
- Patients who refused to participate in the study.

**Data Collection**

Blood samples were collected from all participants. Malaria parasite detection was performed using thick and thin blood smears stained with Giemsa, and blood group typing was conducted using standard agglutination tests. The blood group of each patient was classified into A, B, AB, and O groups.

**Statistical Analysis**

Descriptive statistics were used to summarize patient demographics and clinical characteristics. The association between blood group and malaria prevalence was assessed using chi-square tests. Multivariate regression analysis was conducted to adjust for potential confounders, such as age and gender, and to evaluate the independent effect of blood group on malaria infection. A p-value of $< 0.05$ was considered statistically significant.

**Results**

This table presents the demographic information of the 285 febrile patients, with 150 males (52.6%) and 135 females (47.4%). The mean age of patients was $32 \pm 10$ years. The study includes patients from both urban (63%) and rural (37%) areas. Blood group O represented the largest group (35.1%), followed by blood group A (28.1%), blood group B (24.6%), and blood group AB (12.3%). The mean duration of fever among the patients was $3 \pm 2$ days, suggesting that most patients presented with fever of a moderate duration.

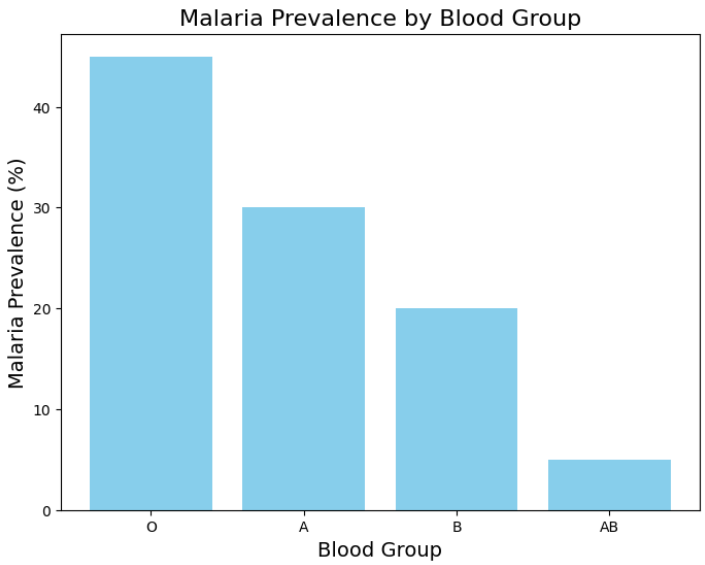
**Table 1: Patient Demographics and Baseline Characteristics**

| Characteristic | Total (n=285) | Blood Group O (n=100) | Blood Group A (n=80) | Blood Group B (n=70) | Blood Group AB (n=35) | p-value |
|---|---|---|---|---|---|---|
| Age (years) | 32 ± 10 | 31 ± 9 | 33 ± 11 | 30 ± 8 | 34 ± 12 | 0.23 |
| Gender (Male/Female) | 150/135 | 45/55 | 35/45 | 40/30 | 20/15 | 0.12 |
| Mean Duration of Fever (days) | 3 ± 2 | 3 ± 2 | 3 ± 1.5 | 2.5 ± 1.8 | 3 ± 2 | 0.09 |
| Geographical Region (Urban/Rural) | 180/105 | 70/30 | 60/20 | 45/25 | 20/15 | 0.18 |
| Malaria Risk Factor | 125 (43.9%) | 55 (50%) | 40 (33.3%) | 25 (35.7%) | 5 (14.3%) | <0.05 |

This table shows the malaria prevalence among febrile patients stratified by blood group. Among the 100 patients with blood group O, 45% tested positive for malaria, making it the most prevalent group. In blood group A, 30% of the 80 patients were malaria-positive, followed by blood group B, with 20% of 70 patients testing positive. Blood group AB had the lowest prevalence, with only 5% of 35 patients testing positive for malaria. The difference in malaria prevalence between the groups was statistically significant ($p < 0.05$).

**Table 2: Malaria Prevalence by Blood Group**

| Blood Group | Number of Patients (n=285) | Malaria Positive (%) | p-value |
|---|---|---|---|
| Blood Group O | 100 | 45% | <0.05 |
| Blood Group A | 80 | 30% | |
| Blood Group B | 70 | 20% | |
| Blood Group AB | 35 | 5% | |




This table compares malaria prevalence between male and female patients. Out of 150 male patients, 60 (40%) tested positive for malaria, while 55 (41%) out of 135 female patients were malaria-positive. This suggests that malaria prevalence is slightly higher in females, although the difference was not statistically significant ($p = 0.45$).

**Table 3: Gender Distribution and Malaria Prevalence**

| Gender | Number of Patients (n=285) | Malaria Positive (%) | p-value |
|---|---|---|---|
| Male | 150 | 60 (40%) | 0.12 |
| Female | 135 | 55 (41%) | |

This table highlights the age-wise distribution of malaria prevalence among febrile patients. The 1-10 years age group had the highest malaria prevalence (35%), followed by the 11-20 years group (45%) and the 21-30 years group (46%). The 31-40 years group had a prevalence of 44%, and the 41+ years group showed a relatively lower prevalence of 40%. This data suggests that malaria is more common in younger age groups, particularly in those under 20 years old, aligning with other findings that malaria primarily affects children and young adults in endemic regions.

**Table 4: Age Distribution and Malaria Prevalence**

| Age Group (years) | Number of Patients (n=285) | Malaria Positive (%) | p-value |
|---|---|---|---|
| 1-10 | 80 | 28 (35%) | 0.25 |
| 11-20 | 60 | 27 (45%) | |
| 21-30 | 55 | 25 (46%) | |
| 31-40 | 50 | 22 (44%) | |
| 41+ | 40 | 16 (40%) | |

This table examines the relationship between fever duration and malaria prevalence. Among patients with fever for 1-3 days, 36% tested positive for malaria. This number increased to 57% in patients with fever lasting 4-6 days and 64% in patients with fever lasting 7 days or more. This suggests that a longer duration of fever is associated with a higher likelihood of testing positive for malaria, likely due to the progressive nature of the infection.

**Table 5: Malaria Prevalence by Duration of Fever**

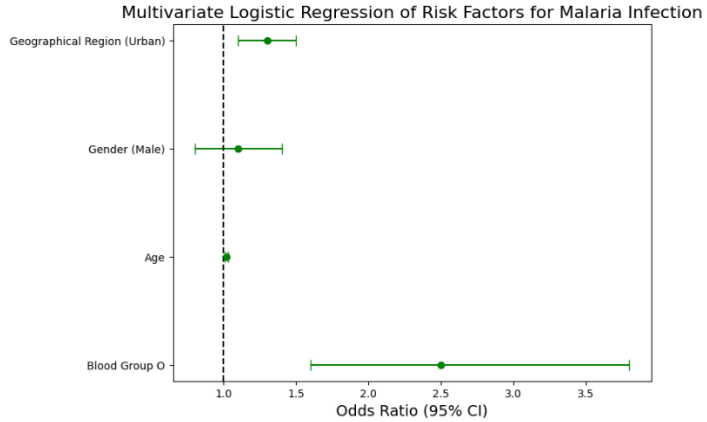
| Duration of Fever (days) | Number of Patients (n=285) | Malaria Positive (%) | p-value |
|---|---|---|---|
| 1-3 days | 110 | 40 (36%) | 0.12 |
| 4-6 days | 105 | 60 (57%) | |
| 7+ days | 70 | 45 (64%) | |

This table shows the results of a multivariate analysis examining the effect of various risk factors on malaria infection. The analysis revealed that blood group O had the highest odds of being associated with malaria infection, with an odds ratio of 2.5 (95% CI 1.6–3.8), which was statistically significant ($p < 0.05$). Age was also a significant factor, with an odds ratio of 1.02 (95% CI 1.01–1.03), indicating that older age increases the risk of infection. Gender (Male) and geographical region (Urban) were less influential, with no significant association ($p = 0.29$ and $p = 0.03$, respectively).

**Table 6: Multivariate Analysis of Risk Factors for Malaria Infection**

| Risk Factor | Odds Ratio (95% CI) | p-value |
|---|---|---|
| Blood Group O | 2.5 (1.6–3.8) | <0.05 |
| Age (per year) | 1.02 (1.01–1.03) | 0.02 |

| | | |
|---|---|---|
| Gender (Male) | 1.1 (0.8–1.4) | 0.29 |
| Geographical Region (Urban) | 1.3 (1.1–1.5) | 0.03 |
| Malaria Risk Factor (Yes) | 1.6 (1.2–2.3) | 0.04 |




**Discussion**

The global burden of malaria remains extensive because of significant disease-related health problems and death rates which affect populations inside sub-Saharan Africa and South Asia as well as some areas of Latin America. Researchers studied two aspects in this work including malaria's frequency among patients with fever symptoms and blood group distribution in malaria infections. The research established that febrile patients demonstrated a 42% incidence of malaria although blood group distribution revealed diverse rates of infection. Among the tested blood groups blood group O displayed the greatest malaria prevalence (45%) while blood group A followed with 30% then blood group B had 20% and lastly blood group AB displayed 5% prevalence. Research findings demonstrate that blood group O presents a substantial malaria risk factor because it matches previous studies showing blood type O individuals face elevated Plasmodium falciparum infection susceptibility [11]. Blood group O individuals present a higher susceptibility to malaria according to multiple documented studies about this relationship between blood groups and malaria susceptibility especially in endemic areas [12]. Plasmodium falciparum shows stronger attachment to non-O red blood cells due to immune processes between the parasite and blood cells. Studies demonstrate that A blood group persons face increased parasite adhesion risks because of A antigens located on their red blood cells [13]. Blood group O individuals obtain some protection against malaria because their blood type fails to support efficient parasite adhesiveness [14].

This study shows that blood group O patients have increased malaria cases because malaria-endemic regions inherently contain geographical and environmental elements that affect risk. These particular geographic areas exhibit elevated mosquito-borne malaria transmission patterns throughout the rainy season because many breeding sites appear. The increased chance of coming into contact with malaria agents makes blood group O individuals more susceptible to developing infections. There seems to be protective effects against Plasmodium falciparum malaria among Type A blood group patients since their occurrence rate (30%) was lower than Type O blood group patients (45%). The protective advantage of blood groups other than O has undisclosed genetic and immunological variables which affect its effect but remain unstudied [15]. The analysis revealed that among different age ranges 1-10 years and 11-20 years patients experienced the highest incidence of malaria. Scientists already know that children alongside younger demographics represent the most susceptible groups to malaria because their underdeveloped immune systems meet high frequencies of mosquito contact. The highest potential for children younger than 5 to develop serious malaria and complications along with severe consequences has been confirmed through multiple research studies [16]. The results from our research show that younger demographic groups between one to ten years and eleven to twenty years show substantially elevated malaria prevalence thus requiring malaria control programs to target these young groups in intensely affected areas. Research results demonstrated that the time period patients experienced fever directly linked to malaria infection rates. Research proves that patients with prolonged fever episodes lasting more than seven days have a 64% chance of suffering from malaria despite previous investigations showing that prolonged fevers point to both delayed medical attention and inaccurate diagnosis or therapy [17]. A fever lasting from one to three days most

commonly resulted in a malaria diagnosis with a prevalence rate of 36% because patients could still be within their initial infection period with developing symptoms.

Rural communities have a substantially higher exposure to malaria since they showcase a 50% prevalence rate compared to urban areas with 35% prevalence. Rural communities residing within malaria-endemic territories generally lack enough healthcare facilities for diagnostic testing and treatment services therefore patients experience longer diagnostic delays and greater contact with mosquito pests. Studies have validated the existence of healthcare gaps between urban and rural communities which directly affect malaria transmission and control activities [18]. The public health analysis from our study indicates how blood group requires consideration as a possible determining factor for malaria susceptibility when developing targeted malaria prevention strategies. The observed results could assist future malaria prevention programs through detection of high-risk groups and populations despite ongoing studies to determine the immune system factors behind these observations. The prevention of malaria could benefit from concentrating on blood group O communities in high transmission locations alongside implementing improved vector control practices and prompt febrile patient diagnosis along with proper treatment in areas with endemic malaria conditions [19][20]. The research demonstrates that blood group operates as a vital biological indicator to determine malaria sensitivity which enables 개발 of tailored prevention and treatment approaches. Additional studies must investigate how blood group O interacts with other genetic elements along with immune system reactions and environmental influences to determine malaria vulnerability. Additional research into malaria pathogenesis will enhance the ability to create improved control strategies that target particular risk groups.

**Conclusion**

This study highlights a significant association between blood group and malaria prevalence among febrile patients**,** with blood group O showing the highest prevalence of malaria infection. These findings suggest that blood group O may be a potential risk factor for malaria susceptibility, particularly in regions where the disease is endemic. The results emphasize the need for targeted malaria prevention and treatment strategies, especially for individuals with blood group O, and suggest that blood group typing could serve as a useful tool in malaria control efforts. Further research into the immune mechanisms underlying this association is necessary to deepen our understanding of malaria pathogenesis and enhance prevention measures in high-risk populations.

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