RESEARCH ARTICLE AGROBIOLOGICAL RECORDS
ISSN: 2708-7182 (Print); ISSN: 2708-7190 (Online)
Open Access Journal

SOCIAL DETERMINANTS AND RISK FACTORS OF MALARIA PARASITE IN DERA GHAZI KHAN, PAKISTAN

Anum Wahid [1], Asghar Abbas [1]*, Ammar Abbas Siddiqui [1], Atif Rehman [1], Muhammad Kashif [2], Tanveer Ahmad [3] and Muhammad Nadeem [4]

[1]Faculty of Veterinary and Animal Sciences, Muhammad Nawaz Shareef University of Agriculture, Multan, Pakistan
[2]Department of Medicine, University of Veterinary and Animal Sciences, Jhang Campus, Pakistan
[3]Department of Clinical Sciences, Bahauddin Zakariya University Multan, Pakistan
[4]Department of Pathology, PMAS-Arid Agriculture University Rawalpindi

Corresponding author: asghar.abbas@mnsuam.edu.pk

ABSTRACT

Malaria is well recognized infectious disease all over the world and in Pakistan which remains endemic in so many areas. Pakistan has been reported to have mainly two species, *Plasmodium vivax* and *Plasmodium falciparum. P. vivax* is far too common, causing several morbidities across the country. On the other hand, *Plasmodium falciparum* is a major source of mortality in Pakistan. Malaria is a major global health issue. Epidemiological data from diverse regions of Pakistan are insufficient to accurately assess frequency of various types of malaria. Climatic conditions of Pakistan provide ideal conditions for mosquito breeding. A cross-sectional study was conducted to find prevalence and associated risk factors of various forms of malaria presenting with fever and its response to anti-malarial medicines in Dera Ghazi Khan. To detect malaria parasites, the blood films were being stained with 10% working solution of Giemsa and microscopically examined using a 100X immersion oil objective and produced a thin blood film. Results of the study demonstrated that overall prevalence of malaria was 45.3% in urban people that shows that it remains a major public health problem in the urban areas.

***Keywords*:** Malaria, Endemic, *Plasmodium*, Urban Population.

Article History (ABR-24-295) || Received: 09 Nov 2024 || Revised: 31 Dec 2024 || Accepted: 17 Jan 2025 || Published Online: 22 Jan 2025

1. INTRODUCTION

Malaria is an endemic vector-borne disease that has a major impact on public health due to which around 3.4 billion people are at high risk. The infectious disease is caused by protozoa of the genus *Plasmodium* having various species in humans (*Plasmodium vivax, P. flaciparum, P. ovale* and *P. malariae*). Among them, *P. falciparum* and *P. vivax* are common in most areas of the world (File et al. 2019; Afrina et al. 2021). *Plasmodium* is transmitted by the bite of female *Anopheles* mosquitoes. It is still one of the serious public health issues in poor and developing countries. Malaria is a parasitic disease with a high fatality rate in the tropical regions. It accounts for around 500 million clinical infections annually and leads to 0.6 million deaths each year worldwide (Obimakinde et al. 2022). Malaria has kept on being the premier reason for dreadfulness and mortality in youngsters under 5 years of age in sub-Saharan Africa and Asian countries (Isiko et al. 2024).

The disease was long supposed to have originated in fetid marshes and named it as malaria. Malaria is the deadliest vector-borne illness around the world. The disease was widespread throughout the world, but it was successfully eradicated in many temperate areas around the mid-twentieth century (Villena et al. 2024). Nowadays, over 40% of the world's population, particularly those living in the world's poorest countries, is in danger of malaria. Pakistan is almost in the middle of the malarial belt which includes tropical and subtropical countries (Snow and Gilles 2017). Asia additionally has extensive intestinal sickness trouble, where 50.9% of cases are brought about by *P. vivax* and 49.1% are brought about by *P. falciparum*. The *Plasmodium* parasite causes both acute and chronic malaria diseases (Ogoina 2011). Malaria transmission relies upon factors connected with the parasite, vector, climate, adequacy of general wellbeing control measures and medication opposition. Meteorological factors, for example, temperature, relative mugginess and precipitation add to mosquito development, endurance and life span (Gopika et al. 2024).

Globally, malaria is a major source of poverty in resource-limited settings, particularly in tropical regions. Malaria's impact extends beyond health facilities and into people's daily lives: children may suffer from long-term neurological effects after severe attacks of malaria, as well as subtle mental and developmental

Citation: Wahid A, Abbas A, Siddiqui AA, Rehman A, Kashif M, Ahmad T and Nadeem M, 2025. Social determinants and risk factors of malaria parasite in Dera Ghazi Khan, Pakistan. Agrobiological Records 19: 19-23. https://doi.org/10.47278/journal.abr/2025.003

ISSN: 2708-7182 (Print); ISSN: 2708-7190 (Online)
Open Access Journal

impairments, resulting severe outcomes. Children under the age of five and pregnant women are particularly vulnerable to the infection of malaria since they have not yet acquired disease immunity (Debash et al. 2022). Children who survive malaria may experience long term effects from the infection. Frequent bouts of fever or illness suppress appetite, social contact and educational opportunities, all of which contribute to poor development.

Malaria is responsible for a major portion of mortality rates which are higher in poorer households. Malaria transmission in urban settings tend to be lower and more localized compared to rural settings. Urban areas offer possibilities for successful vector control along with combined parasite treatment since urban malaria transmission tends to be more localized and lower than in rural settings (Gopika et al. 2024). Despite these facts, major cities have been the primary focus of recent sub-Saharan African urban malaria research. Furthermore, a study conducted in 2014 demonstrated a major association between individuals in the low-income population and malaria infection. Malaria parasites are transmitted in the environment due to various factors which favor the breeding of mosquitoes and also include socioeconomic factors like the livelihood of people affecting public health. The behavioral determinants related to malaria include personal protection, use of mosquito nets and use of insecticide at breeding sites to kill vector population. Each country and areas have their own determinant risk depending on environmental, ecology and local socioeconomic factors. Integrated understanding about the patterns of malaria transmission, risk factors, the environment, and socio-economic conditions of each region need to be understood in the context of developing a malaria control program. Additionally, natural variables like land cover, precipitation, elevation, and temperature fundamentally influence mosquitoes' reproducing, which, thus, influences malaria fever transmission (Rudasingwa and Cho 2024). Numerous studies have shown that people low income groups are more prone to get malaria than their counterparts, which is consistent with our findings. In addition to the different conditions of houses, income also influences the education level attained. High pervasiveness of malaria fever among the dislodged populaces in Africa is an arising challenge for public health issues (Semakula et al. 2018; Moukénet et al. 2024). Malaria has reliably been the essential medical issue in kids under five years of age. In general, three *Plasmodium* species (*Falciparum, malariae* and *ovale*) are implicated however, 98% of malaria fever cases are owing to *P. falciparum*.

Despite global efforts to prevent and control malaria, the 2021 report from the WHO highlights the persistent burden of malaria in the WHO African Region, especially in Sub-Saharan Africa. In Ethiopia, a country where malaria is widespread, various intervention activities such as the use of insecticide-treated nets, indoor residual spraying, and artemisinin-based combination therapy have been implemented (Abeku et al. 2015; Liu et al. 2022; González-Sanz et al. 2023).

Based on above-mentioned factors and risk factors of malaria disease, a cross-sectional study was conducted to find prevalence and associated risk factors of various forms of malaria presenting in district, Dera Ghazi Khan (D. G. Khan) of south Punjab Pakistan.

2. MATERIALS AND METHODS

2.1. Ethical Approval

All examinations were performed after approval of Internal Ethics Committee of Muhammad Nawaz Sharif University of Agriculture Multan (No.DGS/2024/170, Dated 20-03-2024).

2.2. Experimental Design

A cross-sectional study was conducted from June to December 2023 in urban area of district Dera Ghazi Khan Pakistan. For this purpose, people who lived in urban areas of the city were randomly selected. Participants even without fever who had not used anti-malarial drugs or antibiotics in the last month and were agreed to participate and blood samples were collected.

2.3. Samples Collection

A total of 380 blood samples were collected and participants who fulfill the inclusion criteria were included with a random sampling technique. Any person even without malaria signs was available and was included. One subject was chosen at random from each of the selected houses to participate in this study. Participants were also interviewed for history. Those participants who took anti-malarial medication or antibiotic therapy within the last 30 days before enrollment were excluded. Firstly, we pricked the finger for blood and prepared thick and thin Blood Films. There were three measures to take before staining malaria blood films using Giemsa: First, adjust the pH of the buffered water to 7.2 before making the solution of Giemsa stain. Second, make a Giemsa stain solution for usually used staining of blood film. Then Giemsa is used to stain the malaria blood films.

ISSN: 2708-7182 (Print); ISSN: 2708-7190 (Online)
Open Access Journal

2.4 Parasite Identification

Thin and thick Blood Smear Technique using Giemsa stain and blood film microscopy was performed since it is a fundamental approach for the detection of malaria. To detect the malaria parasites, the blood films being stained with 10% working solution of Giemsa and microscopically examined using a 100X immersion oil objective and produced a thin blood film.

2.5 Statistical Analysis

Data were entered and analyzed in SPSS 25V. Quantitative variables were presented as frequency and percentage. Qualitative variables were presented as mean and Standard Deviation. The Chi square test was used to find the association between associated factors. P-value less than 0.05 was considered as significant.

3. RESULTS

Frequency and distribution of malaria in different age groups showed that malaria was highly prevalent in 20-30 years age groups and was less prevalent in individuals of 50-60 years of age (Fig. 1). The mean age was 30.19+10.4 years. Out of the 380 participants, 172(45.3%) were infected with malaria parasites. Overall prevalence of malaria in D.G. Khan was 45.3% as given in Table 1. Prevalence of malaria with respect to population density is given in Table 2 which shows that prevalence was high in highly over-populated areas. Prevalence under the influence of environmental factors is given in Table 3 which shows high prevalence where environmental factors are involved.

Table 1: Overall Prevalence of Malaria

Malaria	Frequency	%
Positive	172	45.3
Negative	208	54.7
Total	380	100

Table 2: Prevalence in Population Density Factor

Population density	Frequency	%
Average	31	8.2
Over-Populated	349	91.8
Total	380	100

Table 3: Prevalence under the influence of Environmental Factor

Environmental Factor	Frequency	%
Yes	341	89.7
No	39	10.3
Total	380	100

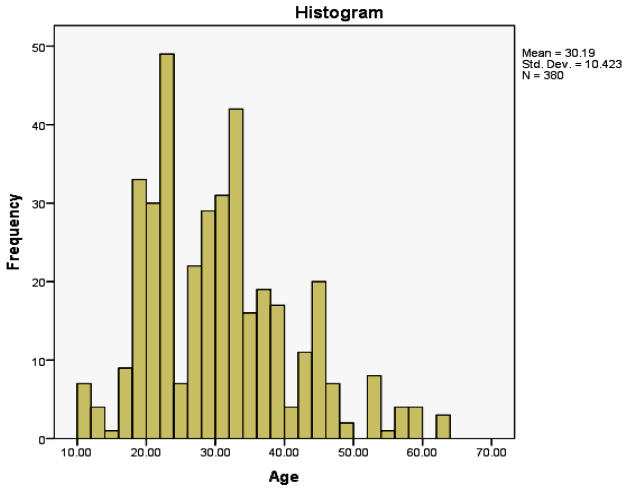

Fig. 1: Malaria Distribution in various Age groups.

4. DISCUSSION

Malaria is an endemic disease of Pakistan, but the disease transmission is unstable, with disease ranging from high in district in FATA and Baluchistan (Umer et al. 2018). Erratic malaria transmission patterns are caused by a variety of factors like climate change, natural disasters, resource constraints, inadequate health facilities, low socioeconomic conditions, limited access to healthcare services and domestic instability (Zhou et al. 2010). According to recent estimates, 29% of Pakistan's population lives in malaria high transmission regions, whereas 69% lives in malaria low transmission districts (Umer et al. 2018). There is a need to investigate the malaria epidemiology in Pakistan in depth, as rigorous research using statistical approaches to explain the dynamics of malaria in the country is insufficient. Despite considerable financial investments and concerted efforts made at both local and global levels to mitigate to transmission of malaria as disease persists as major threat to public health in urban areas, particularly in Pakistan.

The research was conducted to determine the prevalence, frequency and associated risk factors of malarial parasites in the Urban Population of D.G. Khan. Giemsa stained thick and thin blood films were studied. In current study Total 380 participants were included and majority of participants specifically 349(91.8%) were deemed to be overpopulated. 262 (68.9%) participants complained of headaches, 172(45.3%) complained of vomiting. In average population, only 15(48.4%) participants tested positive for malaria, while in overpopulated participants, 157(45.0%) were found to be positive for malaria. Vulnerability to malaria fever is higher in pregnant ladies than in non-pregnant ladies (Bardoe et al. 2024). Malaria transmission relies upon factors connected with the parasite, vector,

Citation: Wahid A, Abbas A, Siddiqui AA, Rehman A, Kashif M, Ahmad T and Nadeem M, 2025. Social determinants and risk factors of malaria parasite in Dera Ghazi Khan, Pakistan. Agrobiological Records 19: 19-23. https://doi.org/10.47278/journal.abr/2025.003

ISSN: 2708-7182 (Print); ISSN: 2708-7190 (Online)
Open Access Journal

climate, adequacy of general wellbeing control measures and medication opposition. Meteorological factors, for example, temperature, relative mugginess and precipitation add to mosquito development, endurance and life span (Gopika et al. 2024). Moreover, exploring the risk factors associated with malaria transmission is important in understanding how the disease spreads and identifying strategies for prevention and control. Due to the high cost of healthcare, lost productivity, and effects on trade and tourism in endemic areas, malaria can have serious repercussions (Kassile et al. 2024; Merga et al. 2024). Overall, a comprehensive discussion on the prevalence and associated risk factors malaria parasites should aim to provide insights into the complex dynamics of malaria transmission, identity vulnerable population and inform evidence-based strategies for prevention and control efforts (Alemu et al. 2011; Cheng et al. 2021).

In one study it was found that malaria infection was connected to a number of geographic and sociodemographic variables. As such, it is crucial to think about putting mitigation strategies in place to deal with the modifiable risk factors for malaria infection. Malaria, an illness traditionally linked to rural areas, is increasingly prevalent in urban environments worldwide, with Africa experiencing a particularly alarming rise in urban malaria cases (De Silva and Marshall 2012). While historically the *Anopheles* mosquito, which carries the *Plasmodium* species responsible for transmitting malaria, was associated with rural breeding grounds, the rapid process of urbanization and demographic changes have challenged this perception, resulting in an elevated risk of malaria in urban areas. Many countries are facing consequences of urbanization on malaria transmission and promotion of vector breeding (Balikuddembe et al. 2023).

To protect the population against malarial parasite and its effects on public health, it is necessary to screen, diagnose and treat people as early as possible to control the transmission in future. Epidemiological data from diverse regions of Pakistan are insufficient to accurately assess frequency of various types of malaria. D.G. Khan is one of hot areas of south Punjab region of Pakistan which provide ideal conditions for mosquito breeding. We conducted this study to find prevalence and associate risk factors with the presentation of various forms of malaria in D.G. Khan. The results of the present study will help the government's ability to develop prevention and control efforts in order to decrease and control the disease burden.

5. CONCLUSION

Despite considerable financial investments and concerted efforts made at both local and global levels to mitigate to transmission of malaria, the disease persists as the foremost threat to public health in urban areas, particularly in Pakistan. According to study findings, overall prevalence of malaria parasite was 45.3% in urban areas of district D.G. Khan and disease was highly prevalent in areas where population density was high. Malaria is a major global health issue. Epidemiological data from diverse regions of Pakistan are insufficient to accurately assess the frequency of various types of malaria. There is a need to investigate the malaria epidemiology in Pakistan in depth, as rigorous research using statistical approaches to explain the dynamics of malaria in the country are insufficient.

Conflict of Interest: The authors declare no conflict of interest.

Acknowledgment: The authors gratefully acknowledge and appreciate the research support from department of Pathobiology and Biomedical Sciences, Muhammad Nawaz University of Agriculture Multan Pakistan.

Author's Contribution: Research Execution: A.W and AA; Manuscript Preparation: A.A, A.R and M.K; Final Review: T.A and M.N.

REFERENCES

Abeku TA, Helinski ME, Kirby MJ, Kefyalew T, Awano T, Batisso E and Meek SR, 2015. Monitoring changes in malaria epidemiology and effectiveness of interventions in Ethiopia and Uganda: beyond Garki project baseline survey. Malaria Journal 14: 1-15. https://doi.org/10.1186/s12936-015-0852-7

Afrina Y, Rahardjo M and Nurjazuli N, 2021. Analysis of Environmental Factors with Malaria Incidence in Mabodo Health Center. Jurnal Aisyah: Jurnal Ilmu Kesehatan 6(3): 599-604. https://doi.org/10.30604/jika.v6i3.702

Alemu A, Tsegaye W, Golassa L and Abebe G, 2011. Urban malaria and associated risk factors in Jimma town, south-west Ethiopia. Malaria Journal 10: 337. https://doi.org/10.1186/s12936-015-0852-7

Balikuddembe JK, Reinhardt JD, Zeng W, Tola H and Di B, 2023. Public health priorities for Sino-Africa cooperation in Eastern Africa in context of flooding and malaria burden in Children: a tridecadal retrospective analysis. BMC Public Health 23: 1331. https://doi.org/10.1186/s12889-023-16220-7

Bardoe D, Bio RB, Yar DD and Hayford D, 2024. Assessing the prevalence, risk factors, and socio-demographic predictors of malaria among pregnant women in the Bono East Region of Ghana: a multicentre hospital-based mixed-method cross-sectional study. Malaria Journal 23: 302. https://doi.org/10.1186/s12936-024-05120-9

ISSN: 2708-7182 (Print); ISSN: 2708-7190 (Online)
Open Access Journal

Cheng B, Htoo SN, Mhote NPP and Davison CM, 2021. A systematic review of factors influencing participation in two types of malaria prevention intervention in Southeast Asia. Malaria Journal 20: 195. https://doi.org/10.1186/s12936-021-03733-y

De Silva PM and Marshall JM, 2012. Factors contributing to urban malaria transmission in sub-Saharan Africa: a systematic review. Journal of Tropical Medicine 2012: 819563. https://doi.org/10.1155/2012/819563

Debash H, Bisetegn H, Ebrahim H, Feleke DG, Gedefie A, Tilahun M and Abeje G, 2022. Prevalence and associated risk factors of malaria among febrile under-five children visiting health facilities in Ziquala district, Northeast Ethiopia: A multicenter cross-sectional study PLoS One 17: e0276899. http://doi.org/10.1371/journal.pone.0276899

File T, Dinka H and Golassa L, 2019. A retrospective analysis on the transmission of *Plasmodium falciparum* and *Plasmodium vivax*: the case of Adama City, East Shoa Zone, Oromia, Ethiopia. Malaria Journal 18: 193. https://doi.org/10.1186/s12936-019-2827-6

González-Sanz M, Berzosa P and Norman FF, 2023. Updates on malaria epidemiology and prevention strategies. Current Infectious Disease Reports 25(7): 131-139. https://doi.org/10.1007/s11908-023-00805-9

Gopika J, Eshwari K, Pandey AK and Shetty RS, 2024. Socio-ecological determinants of malaria transmission risk among population residing in an endemic area of southern province of Karnataka, India. Clinical Epidemiology and Global Health 25: 101489. https://doi.org/10.1016/j.cegh.2023.101489

Isiko I, Nyegenye S, Bett DK, Asingwire JM, Okoro LN, Emeribe NA, Koech CC, Ahgu O, Bulus NG, Taremwa K and Mwesigwa A, 2024. Factors associated with the risk of malaria among children: analysis of 2021 Nigeria Malaria Indicator Survey. Malaria Journal 23: 109. https://doi.org/10.1186/s12936-024-04939-6

Kassile T, Lokina R, Mujinja P and Mmbando BP, 2014. Determinants of delay in care seeking among children under five with fever in Dodoma region, central Tanzania: a cross-sectional study. Malaria Journal 13: 348. https://doi.org/10.1186/1475-2875-13-348

Liu Q, Yan W, Qin C, Du M, Liu M and Liu J, 2022. Millions of excess cases and thousands of excess deaths of malaria occurred globally in 2020 during the COVID-19 pandemic. Journal of Global Health 12: 05045. https://doi.org/10.7189/jogh.12.05045

Merga H, Degefa T, Birhanu Z, Abiy E, Lee MC, Yan G and Yewhalaw D, 2024. Urban malaria and its determinants in Eastern Ethiopia: the role of *Anopheles stephensi* and urbanization. Malaria Journal 23: 303. https://doi.org/10.1186/s12936-024-05126-3

Moukénet A, Moudiné K, Ngarasta N, Hinzoumbe CK and Seck I, 2024. Malaria infection and predictor factors among Chadian nomads' children. BMC Public Health 24: 918. https://doi.org/10.1186/s12889-024-18454-5

Obimakinde ET, Afolabi OJ, Simon-Oke IA and Oniya MO, 2022. Prevalence and Distribution of Malaria Infection in Ifedore Local Government area of Ondo State, Nigeria. FUTA Journal of Life Sciences 1: 28-37.

Ogoina D, 2011. Fever, fever patterns and diseases called 'fever'–a review. Journal of Infection and Public Health 4: 108-124. https://doi.org/10.1016/j.jiph.2011.05.002

Rudasingwa G and Cho SI, 2024. Malaria prevalence and associated population and ecological risk factors among women and children under 5 years in Rwanda. Heliyon 10: e34574. https://doi.org/10.1016/j.heliyon.2024.e34574

Semakula HM, Liang S, Mukwaya PI, Mugagga F, Swahn M, Nseka D, Wasswa H and Kayima P, 2018. Determinants of malaria infections among children in refugee settlements in Uganda. Infectious Diseases of Poverty 12: 31. https://doi.org/10.1186/s40249-023-01090-3

Snow RW and Gilles HM, 2017. The epidemiology of malaria. In: Essential Malariology, 4th Ed, pp: 85-106. CRC Press. https://doi.org/10.1201/9780203756621

Umer MF, Zofeen S, Majeed A, Hu W, Qi X and Zhuang G, 2018. Spatiotemporal clustering analysis of malaria infection in Pakistan. International Journal of Environmental Research and Public Health 15: 1202. https://doi.org/10.3390/ijerph15061202

Villena OC, Arab A, Lippi CA, Ryan SJ and Johnson LR, 2024. Influence of environmental, geographic, socio-demographic, and epidemiological factors on presence of malaria at the community level in two continents. Scientific Reports 14: 16734. https://doi.org/10.1038/s41598-024-67452-5

Zhou SS, Huang F, Wang JJ, Zhang SS, Su YP and Tang LH, 2010. Geographical, meteorological and vectorial factors related to malaria re-emergence in Huang-Huai River of central China. Malaria Journal 9: 337. https://doi.org/10.1186/1475-2875-9-337

Citation: Wahid A, Abbas A, Siddiqui AA, Rehman A, Kashif M, Ahmad T and Nadeem M, 2025. Social determinants and risk factors of malaria parasite in Dera Ghazi Khan, Pakistan. Agrobiological Records 19: 19-23. https://doi.org/10.47278/journal.abr/2025.003