

# Knowledge and treatment-seeking behavior among malaria suspected patients in two hospitals of district Malakand

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## Research Article

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# **Abstract**

## **Background**

Malaria remains a significant public health problem over the last two decades in Pakistan. To prevent malaria infection and develop malaria-free zones, understanding the knowledge, treatment-seeking behavior, and preventive measures toward the malaria infection of the inhabitant are necessary. This study is designed to assess the knowledge, malaria preventive measures, treatment-seeking behaviors, and socio-economic profiles, among suspected malaria patients in district Malakand, Pakistan.

## **Methods**

Current research was a hospital-based cross-sectional study, in which patients attending DHQ hospital Batkhela and THQ hospital Dargai were recruited. A pre-tested semi-structured questionnaire was used to collect demographic characteristics, knowledge, and treatment-seeking behavior of the patients for malaria infection. Data were analyzed using SPSS version 20.

## **Results**

A total of 1100 malaria suspected individuals were interviewed. The respondent's ages ranged from 3-80 years, with a mean of 19.5 years. Participation of Males was more than female, 54.3% and 45.6% respectively. Participants belonging to education departments were more participated in the survey (55%) than others, while most of the individuals were from rural areas (78.1%), and the number of individuals >8 is higher than below <8 members. The majority of the respondents (76.2%) were voted to sleep uncovered than covered (23.7%). Most of the individuals (83.36%) were of the view to use allopathic treatments after getting malaria while only 16.63% were used homeopathy, and financial issues were reported as the major reason for the delay in treatment. Regarding treatment time after getting malaria, 68.8% were received within a week and, 31.3% were within 24 hours. Most of the infected individuals (87.9%) were known that mosquitoes as the causing source of malaria infection, and can be controlled by eliminating breeding grounds, using mosquito repellents and bed net 86%, 7.2%, and 6.6% respectively.

## **Conclusions**

Malakand is one of the malaria-endemic regions of Pakistan. The present study highlighted that the majority of the respondents have good knowledge about malaria infection, mode of transmission of the plasmodium parasite, and preventive measures. Further strategies are required for the control of malaria infection.

## **Introduction**

### **Historic background of malaria**

Regardless of great progress, globally malaria is still a severe vector-borne infectious disease that affects nearly half of the world's population [1]. the Malaria parasite is an endemic species in 109 countries and is widespread throughout the developing countries of the sub-tropic and tropic region [2]. According to World Health Organization (WHO) report, in 2015, globally 212 million cases were recorded, among this 90% were from African Region, 7% from South-East Asia, and about 2% from Eastern Mediterranean Region[3]. Because of malarial infection every year, more than 400,000 people die around the world, the majority of them are children under the age of five. [4].

Pakistan is a malaria-endemic country, with over 670,000 cases and 3159 deaths reported in 2013 [5]. in Pakistan Malaria is the second most common infectious disease [6]. round-about 150 million people are living in malaria-endemic sites [7]. Almost 37% of malaria cases were particularly in the shared border region of Pakistan with Iran and Afghanistan [8] In 2015, malaria-related deaths occurred in nearly 13 nations, accounting for nearly 75 percent of all deaths. The four nations that account for 81 percent of malaria deaths are Pakistan, India, Ethiopia, and Indonesia [9]. According to the most recent WHO survey, in 2019, Pakistan is affected by approximately 700,000 malaria cases [10]. According to the previous studies, travelers and returning travelers from Pakistan having greater contribution in importing malaria cases to Saudi Arabia [11, 12] the United Arab Emirates[13], Bahrain [14], Qatar[15, 16] Kuwait[17], Jordan [18] and Egypt [19].

According to WHO report 2020, regardless of great progress in decreasing malaria-related morbidity and mortality, the target for the decrease in malaria cases is not yet obtained, further strategies and struggles are required to obtain the malaria-free zone and zero mortality and morbidity rate associated with malaria. Lack of knowledge and public health facilities, poverty, migration of people across the border (including IDPs) are the factors that contribute to malarial infection in district Malakand. The present study is designed to assess the knowledge and treatment-seeking behavior of the people living in district Malakand of Pakistan, and increase the awareness of the inhabitants of district Malakand.

## **Objectives of the study**

The current study bears the following objectives

- To know the level of knowledge of the local residents regarding malaria and its vector
- To know the treatment behavior of the local residents regarding malaria infection

## **Materials And Methods**

## **Study design and data collection**

We carried out a cross-sectional, well-organized, descriptive, community-based survey among malaria-suspected patients visiting two sort-out hospitals of District Malakand, Khyber Pakhtunkhwa, Pakistan, to determine knowledge and treatment-seeking behavior regarding malaria among the general population of the study area. The included hospitals were District Headquarter Hospital (DHQ) Batkhela and Tehsil

Headquarter Hospital (THQ) Dargai. The study was conducted from April to July 2021 during the third phase of COVID-19 to evaluate the knowledge and treatment-seeking behavior for malaria suspected patients. Data were collected from inhabitants (both adults and children) from different localities of the district who are easily accessible. Respondents belonged to different ages, gender, family size, and different occupation.

## **Study area**

Geographically, district Malakand is located in the northern parts of Khyber Pakhtunkhwa province, Pakistan. The area was incorporated into the Malakand Division in 1970 [88]. It is situated within the coordinates at 34° 35' North latitude and 71° 57' East longitude. District Lower Dir, is located to the north, District Swat to the northeast, District Buner to the east, Mardan and Charsadda districts to the south, while on the west it is bounded by Mohmand and Bajaur agencies [20].

District Malakand is present between the rocky and partly glaciated mountain peaks of the Hindukush to the northern edge of the Peshawar valley. District Malakand region is the entrance to district Swat, District Dir upper and lower, districts of Chitral and Federally Administered Tribal Areas (FATA, now it is integrated to the districts) which attract thousands of tourists each year. District Malakand is divided into two main Tehsils which are Tehsil Dargai and Tehsil Batkhela. Tehsil Dargai (Sama Ranizai) is located in the foothills of district Malakand. On the north and southwestern sides, Tehsil Batkhela (Swat Ranizai) extends from Mohmand and Bajaur Agencies. The River Swat separates it from Dir Lower [21].

## **The climatic condition of district Malakand**

Summers in Malakand are hot and clear, while winters are cold and partly cloudy. The temperature normally ranges from 39°F to 105°F throughout the year, with temperatures rarely falling below 33°F or rising over 111°F. The probability of rainy days fluctuates throughout the year in Malakand. From January 28 to September 9, the wetter season lasts 7.4 months, with a greater than 17 percent probability of rain on any given day. On March 26, the chances of rain reaches a high of 28 percent. From September 9 until January 28, the drier season lasts 4.6 months. On November 22, the likelihood of rain is at its lowest, at 6%. Malakand receives rainfall all year. With an average total accumulation of 2.8 inches, the most rain falls during the 31 days centered on March 19. The perceived humidity in Malakand varies dramatically throughout the year. From July 1 to September 11, the hottest part of the year lasts 2.3 months. August is the hottest month of the year.

## **Research ethics approval and informed consent**

The study's ethical approval was permitted by the institutional review board (IRB) of the University of Malakand, Chakdara, district Dir lower, Pakistan and verbal consent were obtained either from respondents or their parents or guardians.

## **Study population & Socio-Economic Profile**

The majority of the people in the area depending on agricultural products for survival. The principal source of income for the local inhabitants is agriculture. Wheat, sugarcane, tobacco, rice, and maize are the main cash crops grown in the area. In addition, the Malakand area is home to a variety of vegetables and an orchard. Wheat takes up the majority of agricultural land in the project area. The overall cultivated area for wheat in district Malakand is 26727 hectares, with 9715 hectares of irrigated land and 17012 hectares of unirrigated land [21].

On the other hand, agricultural products, are insufficient to meet the needs of native residents. As a result, people must turn to different sources of income to support themselves. A particular amount of the people are performing their duties in different government and private sectors of the country. A large number of people also move outside of the country for trading and occupations. Women do housekeeping responsibilities and manufacture handicrafts such as hats, bedsheets, and baskets, while a large number of males labor in the civil armed forces and other regions of the state. It's a huge hilly region, and women help their men by caring for cattle, cutting wood for the fire, and working in the fields [22].

## **Data collection tool**

A self-administrated questionnaire was used for the data collection because it was easy to conduct a community-based survey during the pandemic of the COVID-19 outbreak. The questionnaire was drafted in English and translated to the local language for the facilitation of uneducated participants, and back-translated into English to check the validity and accuracy of the questionnaire. After correction, the questionnaire was sent to statistics expertise to check their reliability, after that the questionnaires were distributed randomly among malaria suspected patients who were visited the two referral hospitals DHQ Batkhela and THQ Dargai of district Malakand to assess the malaria knowledge and treatment-seeking behavior of the residents. The questionnaires were composed of mainly three sections. The first section containing sociodemographic characteristics of the respondents comprising questions such as age, gender, locality, family size, sleeping habit, the animal type they have, education level, occupation, and the drugs previously used. The second section is composed of questions regarding knowledge of malarial infection, mode of transmission, and the preventive measures, with two multiple options. The third section included questions about the treatment-seeking behavior of participants regarding malarial infection, like measures taken after getting malaria, treatment after getting malaria, and the reason for the delay of treatment. Participants were assured that the information collected would remain confidential. The questionnaire-based survey enables the research team to collect community-based data and extract the opinions of a huge number of participants.

## **Data analysis**

A descriptive, well-organized, community-based, cross-sectional study was carried out. 1100 participants were chosen through random sampling from the district Malakand region. The data completeness was assessed before analysis. SPSS statistical software version 20 was used for data analyses, 0 was coded for No while 1 for Yes. At least two times, the questionnaire was evaluated to ensure the accuracy of data entry, before the actual analysis. Descriptive statistics tools such as frequency, percentage were used to

describe and summarize the data & make it more comprehensible. P values less than 0.05 were considered to be statistically significant.

## Results

### Socio-demographic information of study participants

Regarding age 59.63% of respondents were 3-16 years old, 25.18% were 17-34 years old, 10.81% were 35-50 years old and 4.36% respondents were 51-80 years old. According to the data below in Table1, the maximum of the participant was 3-16 years old at the time of the research, because younger respondents can be easily interviewed than elder people because of their more social contacts than old age people. Gender-wise the respondent are distributed into two categories, male and female. The majority of the respondent (54.36%) were male and 45.63% were female. A higher ratio of male respondents than females is due to cultural and religious boundaries. Concerning the area, 21.81% of the respondent were the inhabitant of the urban area and 78.18% of the respondent were belonging to the rural areas because most of the people of the study area are living in villages. On the other hand majority of the participant (71.90%) family size is less than 8 members and 28.09% of the participant's family size is greater than 8 members because most of the people living in the form of joint family.

Most of the respondents (55.09%) were related to the education department, 16.18% of respondents were related to agriculture and 28.72% were laborers. Majority of the respondent home is mud made, while some of the respondents were living in the house made of bricks (Table 1).Inhabitants of the area are most farmers having different types of animals.56.63% of people having cattle in their homes, 35.72% having pet animals and 7.63% of the people do not have any animal in their homes. On the other hand 23.72% of the people are covering their bodies during sleeping, and 76.27% of people who are not covering their bodies have high chances of malarial infection. According to data collected from the respondent, show that 50.81% of respondents were matric as education level, 29.63% of respondents were primary education level and 19.54% were at Middle level at the time of the study. The researcher explored that majority of the respondents were Matric level at the time of the research. On the other hand, most of the participants (92.09%) does not previously use any drug for the treatment, and 7.90 % have previously used drugs. Results are shown in Table 1.

**Table 1**  
**sociodemographic information of the respondents of malaria suspected patients among the general population of Malakand district, Pakistan**

Factors	DHQ Hospital Batkhela (700)	THQ Hospital Dargai (400)	Total number (1100)	Percentage (%)
<b>Ages (Years)</b>	3-16	418	238	656
	17-34	163	114	277
	35-50	88	31	119
	51-80	31	17	48
<b>Sex</b>	Male	396	202	598
	Female	304	198	502
<b>Areas</b>	Urban	142	98	240
	Rural	558	302	860
<b>Family size</b>	<8	495	296	791
	>8	205	104	309
<b>Occupation</b>	Education	381	225	606
	Agriculture	105	73	178
	Labor	214	102	316
<b>House type</b>	Brick made	551	308	859
	Mud made	149	92	241
<b>Animal types</b>	Cattles	407	216	623
	Pet animals	243	150	393
	Not found	50	34	84
<b>Sleeping habits</b>	Covered	157	104	261
	Un-covered	543	296	839
<b>Previously used drugs</b>	Yes	75	12	87
	No	625	388	1013
<b>Education level</b>	Primary	225	101	326
	Middle	180	35	215

Factors	DHQ Hospital Batkhela (700)	THQ Hospital Dargai (400)	Total number (1100)	Percentage (%)
Matric	295	264	559	50.81

## Knowledge

Majority of the respondent having good knowledge about malaria. Most of the patients (87.9%), were agreed that malaria can be transmitted through mosquitoes bites, 5.34% of the respondents answer that malaria can be transmitted by fly/insects bite, and according to 6.90% of the respondent, lack of cleanliness is the main cause of malaria. Similarly, 86.09% of the respondent suggest that eliminating breeding grounds is the best way of preventing malaria, 6.63% of the respondent were agreed with using bed nets, and 7.27% think that using mosquito repellents is the best way of malarial prevalence. Information related to the knowledge of the respondent is shown in Table 2.

Table 2

Knowledge of the respondents of malaria suspected patients among the general population of Malakand district, Pakistan

Factor		Frequency (1100)	Prevalence (%)
How does a person get malaria	Mosquito bite	967	87.90
	Fly/insect bite	58	5.34
	Lack of cleanliness	76	6.90
How malaria can be prevented	Eliminating breeding grounds	947	86.09
	Bed nets	73	6.63
	Mosquito repellents	80	7.27

## Treatment seeking behavior

Regarding treatment-seeking behavior, 83.36% of the respondents take allopathy clinic measures, 11.63% were taken homeopathy clinic measures, 5% were taken home remedy measures after getting malaria. 100% of the respondent take some sort of measures after getting the infection (Table 3). Most of the respondents (68.8%) start treatment within a week after getting malaria, 31.3% of the respondent take treatment after 24hours. Each and everyone gets some type of treatment, it may be allopathy, homeopathy, or home remedy (Table 3). In relation to the reason for the delay in treatment, 46.36% of the respondents described the reason for the delay in treatment as their financial problem, 29.36% show self-medication, and 24.27% of the respondents were not aware of the infection. It was known by the researchers that financial problem is the main reason of delay treatment (Table 3).

Table 3  
treatment-seeking behavior after getting malaria among the general population of Malakand district,  
Pakistan

<b>Factor</b>		<b>Frequency (1100)</b>	<b>Prevalence (%)</b>
<b>Measure taking after getting malaria</b>	Allopathic treatment	917	83.36
	Homeopathic treatment	128	11.63
	Home remedy	55	5.0
	No measure was taken	0	0
<b>Treatment time after getting malaria</b>	Within a week	756	68.8
	Within 24 hours	344	31.3
	No treatment taken	0	0
<b>Reason for delay in treatment</b>	Not aware	267	24.27
	Self-medication	323	29.36
	Financial issues	510	46.36

## Discussion

The prevalence of malaria in the Malakand region is possibly high because of the high density of mosquito population due to changing climate factors. However, there was a lack of data on the knowledge, attitude, and health-seeking behavior regarding malaria in this region [6].

In the present study, a total of 1100 participants were included. According to the study of Zahid et al 2018, a total of 3840 malarial patients along the Pak-Afghan boarding areas were included, High prevalence of malaria infection may be due to traveling across the border [23]. Another study is carried out in 2018 by Umar and his colleagues, in this study they included a total of 1,593,409 respondents across the whole country of Pakistan [24]. Similarly, another study is conducted in 2013 by Khan and his company in the highly affected district Bannu, of Khyber Pakhtunkhwa province, Pakistan, in whom they included 823 participants [25]. Outside Pakistan recently a study was conducted in the Democratic Republic of the Congo by Ntamabyaliro, in which a total of 1732 household participants were included [26]. A high number of cases show that particular areas are endemic for malarial parasites (plasmodium). The high rate of prevalence may be due to factors like the migration of internally displaced peoples (IDPs) from unrest regions, socio-economic conditions, overcrowding, and other environmental issues.

In the current study age of the respondents ranging from 3-80 years, out of 1100 participants, 656 (59.63%) respondents were 3-16 years old, 277(25.18%) respondents were 17-34 years old, 119 (10.18 %) respondents were 35-50 years old and 48 (4.36%) were 51-80 years old. The mean age of the respondents

was 19.5 years. In 2019 Adhikari et al studied treatment-seeking behavior for febrile illnesses and its implications for malaria control and elimination in Savannakhet Province, Lao PDR (Laos), the age range of the respondent were 18-80 years with mean =  $37.58 \pm 12.719$  [27]. A cross-sectional study was carried out by Mitiku to study the Caregiver's perception about malaria and treatment-seeking behavior for under the age of five years children in the Mandura district of West Ethiopia, the age ranging of the included participants was from 18-55 years [28]. In 2010, Khan and his colleagues study the KAP of malaria during their study in Khyber girl's medical collage Peshawar, Pakistan. The mean age of all the patients was 41 + 14.9 years [29]. Another study was carried out on the student of a religious school in Bannu district Pakistan, whose age ranged was from 5-19 years [30].

Participation of the male is greater than females in the present study, shown in Table 2. A similar study is carried out among Ugandan rural women, for malaria detection, Treatment seeking behavior, and perceptions about the causes of Malaria. In contrast to the present study, the female to male ratio was around 1.2:1 respectively [31]. Less participation of the female than males in the present study is due to religious and cultural customs and traditions.

In this study majority of the respondent (71.18%) were from the rural areas of district Malakand and most of them having more than 8 members in their family. A similar study was conducted by Deressa and his coworkers ta access household socio-economic factors about childhood fever illnesses and treatment-seeking behavior in an endemic malaria region of rural Ethiopia [32]. While another study conducted in Mandura District, West Ethiopia by Mitiku et al, in which 25.7% of the respondent having a family size less or equal to 6 while 60.4% of the respondent having a family size <6 members [28]. The high number of individuals in the family is due to the joint family system in the Pashtun culture.

In this study majority of the participants were education-related, followed by farmers and day labor. In northwest Ethiopia, Workineh et.al conducts a study to access treatment-seeking behavior for malaria, more than half of the respondents were composed of Farmer (54.4%), followed by day labors, (12.9%) [33]. Another study was conducted in Ethiopia in which 32.9% of the participant were Housewife, 19.3% were Merchant,10.2% were farmers, 9.3% were daily laborers, 7.7% were government employees, 6.9% were factory workers, 5.2% were seeking a job, 5% were students, and 4% were others [34].

In the present study most of the respondents having houses made of bricks (78.09%) followed by mud (21.90%). In contrast as a study conducted in Savannakhet Province, Lao PDR (Laos) to access the Treatment-seeking behavior for febrile illnesses and its suggestions for malaria control and eradication, according to the sociodemographic information of the study, 44.8% of the respondent houses were made of Bamboo, 67.3 % were made of wood, 0.4% of the concrete, 3.6% were made of plastics and 2.8% of the house's wall were made of metals [27]. By comparison, in Laos, the majority of the home is made of wood due easily availability of wood and large scale forests. in contrast, bricks are cheap and easily available in Pakistan.

In this study, most of the respondents (56.4%) having cattle's, 35.4% of the respondent having pet animals, and 8.10% does not have any domesticated animals. While the majority of the respondent

(92.2%) have previously used drugs for their treatment and the other respondent (7.74%) doesn't use drugs previously for their treatment. Previously conducted studies for the assessment of malaria knowledge and treatment-seeking behavior, don't provide any attention to these two factors.

In the present study, most of the patients (50.81%) of respondents were matric as education level, 29.63% of respondents were primary education level and 19.54% were at Middle level at the time of the study while according to a study conducted earlier, maximum of the participant were poor, mostly belonging to remote villages and their level of education is relatively poor due to lack of facilities [35]. Urama et.al conducted a similar study in 2021 for the determination of choice and treatment-seeking behavior of rural households in south-east Nigeria, 41.7 percent of household heads having no proper education, 35.2 percent only have a primary school education, and 15.9 percent have secondary school education [36]. Jima et .al conduct a study on the uses of insecticide-treated mosquitos nets as a preventive measure, in which 41.9% of the respondent were literate, 22.3% were of Grades 1-6, 21.7% were of Grades 7-12, 6.1% were of Above 12 grade 6.1 and only 8% of the respondent can read and write [34].

Knowledge about malaria is the most important risk factor in Malaria control and prevention [37–43]. Unfortunately, only a few researchers have successfully identified the malaria parasite as the causative agent of malarial infection. [37, 41, 44], and also act as a source of infection transmission [45–47]. It is also communicated that male participants were generally more knowledgeable as compared to female participants about the transmission and cause of malaria [37]. However, a study conducted in Afghanistan stated that Afghan women were unexpectedly knowledgeable (>75%) than males about transmission, causative agent, and prevention of malaria [48]. in the present study Knowledge about malaria is divided into two categories, which are knowledge about the mode of transmission and preventive measures.

Most of the respondents (shown in table 7) were in favor that mosquito is the causing source of malarial infection. In comparison to another study, 93% of the respondent claimed that malaria can be transmitted by mosquitos [34]. Dambhare et al., 2012 conducted a study among school adult students and other staff members, reporting that only 8.6 percent of the students were aware of the causal agent and over 33% of the participant claimed that houseflies are involved in malaria transmission [46]. A similar study is conducted in Khyber Girls Medical College, Peshawar, Pakistan, and a total of 51 respondents have participated. Most of the participant (76%) knew that mosquitoes are the vectors of the malarial parasite, and only 20% Of the participant was agreed that using of mosquito nets are necessary for the control of malarial infection [49]. another study was conducted in Ethiopia and 1933 participants were included, About 93% of the participants knew that malaria can be transmitted through mosquito bites and the majority of the participant (92.5%) were interested in using mosquito nets in the future to control malarial infection [34]. A similar study is conducted in the tehsil Bandagai, district lower Dir, which is situated to the south of district Malakand, in which 108 participants were included and 57.41% of the respondent replied that mosquito bite is the source of malarial transmission [50]. While in the present study very low number of participants voted for lack of cleanliness 6.85% and fly/insect bite was voted by 5.34%. Another study stated that polluted water, food, contact with an infected individual, and rain are the source

of malaria transmission, 24 percent of respondents properly answer that mosquitoes are transmitting malaria [35].

The National Malaria Control Programmed (NMCP) has made significant progress in malaria control during the last 20 years [51]. In the present study eliminating breeding grounds was the factor mostly voted by the individuals 86.09%, A very less number of participants(7.27%) favored the use of mosquito repellents and bed net 6.63%. According to previously conducted studies, malaria can be prevented by eliminating breeding grounds [45].

The uses of mosquito nets and their efficiency were mentioned in previous researches, however, their uses are limited due to lack of availability, prices, and safety concerns [48]. According to a study of Jima in Ethiopia, only 4.8% of participants voted for DDT and chemotherapy as a preventive measure against malarial infection individually [34]. According to certain studies people are covering their entire body, using repulsive coils and sprays, removal of stagnant water from the environment as preventive strategies [38, 44, 52].

Traditional methods, such as applying lamp or motor oil on the skin, building campfires, burning grass, and sleeping wrapped in a damp blanket, applying herbal oil, were chosen by specific ethnic groups in some parts of Saudi Arabia. To minimize mosquito bites, the most prevalent traditional method is to burn wood and cow dung.[35, 48].

In the present 23.72% of the participant respond that they are covering their body during sleeping, while the majority of the respondent does not cover their body during sleeping. Another study is carried out in Tanzania to access the KAP of the symptomatic patients attending Tumbi Referral Hospital, they attended a total of 277 patients, 38.63% of the participant responded that they are wearing long-sleeved clothes during sleeping, while 61.37% are sleeping without covering their body [53].

Limited data is available on treatment-seeking behavior [54]. According to the available data Self-treatment and obtaining support from drug salespersons were the most common practices in Teikkyi township and Shan Special Region II [55]. A study is carried out in southeast Nigeria, In this study among 471 patients, 84 patients used traditional mediation, and the remaining obtained medication from Pharmacy, Health center, Hospital, and Chemist 45, 65, 74, and 203 respectively [36]. Another study is carried out in the Democratic Republic of the Congo in 2021, in which 1732 households participants were included, 70.1% knew the recommended antimalarial drugs, and 58.6% were habituated to self-medication [26]. Similarly study by Ahmed and his companions in 2009 observed that the participants preferred homeopathic treatment over allopathic medicine. Even when a fever was detected, this resulted in delays in getting medical care [56]. In the current study, most of the respondents 83.36% were of the view to use the allopathic treatment after getting malaria, while only 16.9% were used homeopathic treatment.

It is predicted that about 70–80% of the population accesses the private sector for treatment [57]. According to the Responses of the respondent of a survey, that most of the individuals are seeking

treatment from traditional health works, due to lack of public mobility, therefore people are walking considerable distances to acquire basic healthcare at primary healthcare centers [58]

Regarding treatment time after getting malaria, 68.8% were said within a week and 31.3% were of the view to treat within 24 hours. In the China Myanmar border area, only 32.0% of malaria patients sought treatment within 24 hours and 20.1% were tested for confirming the diagnosis [54]. According to other studies, Malaria patients would rather wait a few days and treat themselves with home treatments, if the condition did not seem to improve, then the victims sought treatment from traditional healers [41, 59].

When asked about the reason for the delay in treatment, most of the respondents (46.36%) described the reason for the delay in treatment as their financial problem, 29.36% show self-medication, and 24.27% of the respondents were not aware of the infection. Some of the studies reported that delays in treatment and health-seeking practices were primarily due to remote health facilities, long waiting times, unfriendly health workers, a lack of money, a loss of faith in the medical profession, and a lack of people to accompany patients in health services. [37, 59, 60].

Due to socioeconomic and cultural characteristics, the current study findings disclosed that participants' knowledge of malaria is similar to earlier studies conducted in Nigeria [86], Zimbabwe [87], and the southern Nigerian community [88]. Similar data have been published in Ethiopian studies, indicating that malaria primarily affected poor and underserved tribal populations living in faraway forest areas, from health facilities.[61, 62].

## Conclusions

The present study highlighted that the majority of the respondents have good knowledge about malaria infection, mode of transmission of the plasmodium parasite, and preventive measures. According to the present study results, the rural population was more infected by malaria than the urban population. Most malaria suspected patients were farmers and having cattle in their homes, followed by pet animals. Most of the individuals were of the view to use allopathic clinics after getting malaria while only a few respondents were favored to use homeopathy and home remedy for malaria infection. The majority of the respondents started treatment within a week after getting the malarial infection and the major cause for delay in treatment is due to financial issues.

## Limitations of the study

In the current study, the data was collected from only malaria suspected patient, because of the limited resource is available in the area like transport and a suitable source for finding the individual who is at high risk of getting malaria. Only questionnaire-based data collection was carried out due to limited lab facilities. Majority of the respondents in the present study was education-related, due to the limited literacy individual in society. Environmental factors like climate, temperature, seasonal variation, humidity, rain, and snowfall were not taken into consideration. Association of the malaria infection with the daily activates of the respondents was not considered.

# **Recommendations**

The present study finding was insufficient to answer some of the questions. Therefore further studies are required to cover the gap between the present study and the questions that arose during the study. On behalf of the present study results, the researcher recommends the following to the newcomers in the field. Study the association between the demographic information, with the prevalence of malaria in this particular area. Correlation between the altitudinal variation and the prevalence of malaria and the association of malarial infection with other lethal diseases. Public health workers, health care providers, and policymakers can help in the implementation of an effective intervention approach to raising malaria awareness among the general population especially parents of children under five and other malaria suspected individuals and encourage them to seek treatment. To find the relation between the blood group and the malaria prevalence. The local population of the area must be ensured the cleanliness of their environment to prevent the transmission of plasmodium by eliminating the breeding site of the plasmodium. All of this needs education and training, cooperation of public-private sector organizations, and regional community awareness.

# **Declarations**

## **Ethics approval and consent to participate**

This research was approved by the Ethical Review Panel, Department of Zoology, University of Malakand and consent from the participants was obtained during data collection.

## **Consent for publication**

Not applicable for that section

## **Availability of data and materials**

The data is available in the custody of 1<sup>st</sup> author of the article

## **Competing interests**

Authors have declared that they have no competing interest

## **Funding**

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## **Authors' contributions**

WK supervised the research, SAS carried out the collection and writing the manuscript, SUR, MT,ZU, and NU help in drafting the manuscript. All the authors have approved the manuscript for publication.

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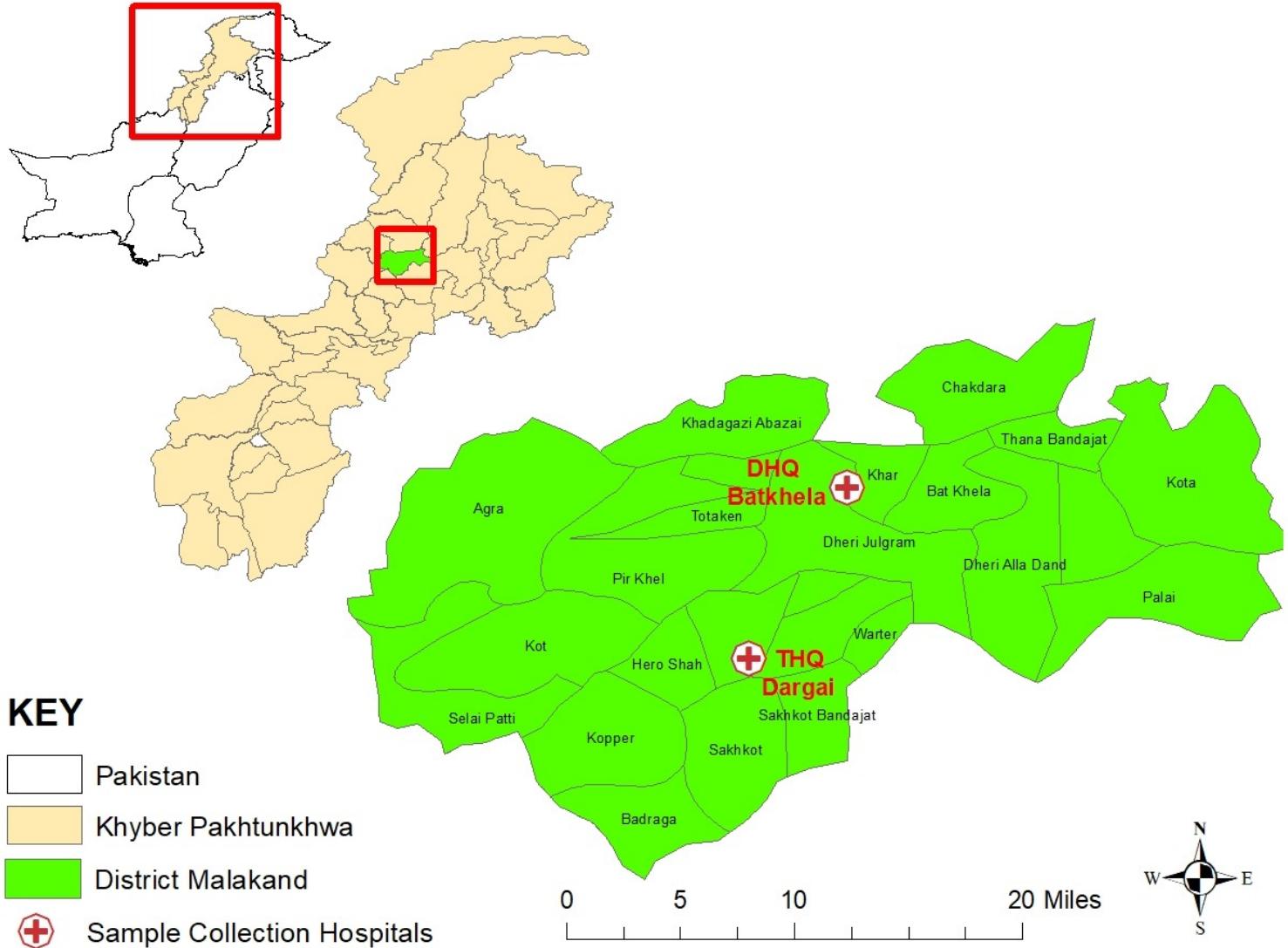
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## Figures



**Figure 1**

Map of District Malakand showing the study spots (hospitals)