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Prevalance Of Mixed Malaria Infection From Different Districts Of Khyber Pakhtunkhwa

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Abstract

A mosquito-borne known as malaria, an infectious disease in humans and different animals caused by genus Plasmodium. For both Plasmodium species P. falciparum and P. vivax Pakistan is one of the most endemic area. About 150 million people reside in these malaria-endemic regions. The current study aimed was to find out the mixed malaria infection from different districts from KPK. A retrospective cross sectional study was done from March 2023 to July 2024. Secondary data were collected form three different hospitals in various districts in KP region. All ages, all genders with all occupation having sign and symptoms of malaria. Blood

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samples will be collected from suspected malaria patients during April-July 2024 at malaria clinics in District Headquarters Hospital (DHQ Karak), Khalifa Gul Nawaz Hospital (KGN Bannu), District Headquarters Hospital (DHQ Buner) sites. Microscopy and RDTs will be performed. For microscopy, thin as well as thick blood smears will be prepared using venous and finger prick blood samples. Out of a total of 11487 patients, 82 0.71%, were positive for Plasmodium falciparum, 3.62% Plasmodium Vivax, while mix infection were observed 0.087% patients. Overall, 511 were positive individually for P. vivax and P. falciparum (Mixed infection) in 2021 in Buner Region while in 2022 mix infection P. vivax and P. falciparum in 18 patients, while in 2023 the mixed infections was observed in 0.08% patients. In district Bannu during 2021 mix infection were observed in 0.14% patients, 0.195% in 2022 and 0.16% in 2023, respectively. In district Karak the mix infection PF+PV were observed in 0.038% of patients in 2021, 0.02% and in 0.153% during 2022 and 2023, respectively. The Plasmodium vivax was found more as compared to plasmodium falciparum, and the overall mixed infection was found in Bannu. The overall prevalence of mix malaria infection was predominant in Bannu followed by Karak and Buner. Proper control programmed should be adopted to control the malaria infection.

INTRODUCTION

Malaria from its prehistoric era is as a zoonotic disease in Africa region within the primates till to the 21th century. Malaria probably lethal human infectious disease, at its height malaria infected each continent, except Antarctica. Its prevention and remedies have been directed in technology and medication for masses of years. For the reason that discovery of the parasites which reason it, research interest has centered on their biology, in addition to that the causative agent of this parasites is mosquitoes. The most critical elements inside the eradication as well as their spread are human behavior including moving population centers, altering farming strategies and so on) and residing standards. Particular data no longer exists due to the fact many instances occur in rural areas in which humans no longer have entry to hospitals or any health care system. Majority of cases are unprotected. Low standard living has been concerned with this type of disorder, and its periodic fevers are observed at some point beginning during 2700 BC in China. Many years ago, conventional natural treatments were used to deal with malaria. The bark of cinchona tree the first effective remedy for malaria came here, having quinine. After the hyperlink to parasites and mosquitos have been diagnosed during 20th century, also management was done using DDT, the swamp drainage, and oiling the surface of open water resources, indoor spraying and insecticide use of treatment was recommended. Quinine usage in prophylactic treatment also prescribed in malaria targeted areas, and new therapeutic drugs such as artemisinin together with chloroquine and were also used. In each 12 months duration two hundred million patients, killed extra than 600,000, encountered in the U.S. Troops in the region of South Pacific at some stage in global warfare II, where in approximately 500,000 men had been infected. In line with Joseph Patrick Byrne, "60 thousand American infantrymen died of malaria throughout the South Pacific and African campaigns. During 20th century, malaria becomes endemic in more than 100 countries at some point of the tropical and subtropical zones, along with massive regions of important and South America, Africa, Hispaniola, Southeast Asia, and the center East, Indian, and Oceania. Plasmodium resistance to anti-malaria drugs, and pesticides and the invention of other parasite species have complex manage measures. [1]

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MALARIA

Malaria is an infection of humans and different animals caused by Protists belonged to the genus Plasmodium. It start with a chunk of a female infected mosquito, leads the protists through saliva and get into the circulatory system, then liver where its completes its reproductive phases. The signs and symptoms that typically consist of headache fever, in severe cases may develop into Coma or demise. Malaria is remarkable in tropical and subtropical regions, as well as in Americas, Asia, and Sub-Saharan Africa. The malaria term comes from Medieval Italian: mala aria means "awful air"; the ailment turned into an ague or marsh fever due to its presence in marshland and swamps places and soon affected most of the world regions such as Europe and North America, in which it's far now not endemic, although imported instances do occur. Different Plasmodium species motive infections in positive animals. Numerous mammals, reptiles and birds have their very own type of malaria. [2]

CAUSATIVE AGENT

As the discovery of Plasmodium as a causative agent of malaria, brownish pigment inside the spleen, liver, and brain become observed by most of the pathologists who conducted necropsies on the dyed malaria patients. The infection of erythrocytes by Plasmodium describes three factors play a key role in the pathological lesions in diverse organs such as parasitemia, destruction of erythrocytes, and the protection reaction of the host towards the infection, which include phagocytosis and the improvement of immunity. Unicellular protozoan parasites which is the causative agent of malaria belonging to the genus Plasmodium. Several species of plasmodium are involved in the sickness of humans. The intracellular parasite which accumulates malaria pigment in the form of insoluble hemoglobin metabolite. These parasites infect now not most effective people however also different vertebrates, from reptiles then birds and into the mammals. So far, over 2 hundred species of Plasmodium were officially described, and every species infects a positive range of hosts. The contiguous recognized family member of P. Falciparum is a chimpanzee parasite, known as Plasmodium Reichen Owi, of which one single isolate become formerly regarded. The hypothesis suggests that both of the parasites evolved separately from a common ancestor having 5-7 million years, with their host divergence, as hominin and chimpanzee. In regions endemic to malaria, many human beings bring Plasmodium without developing signs because of acquired immunity. Frequently, the parasites presence in the one's carriers cannot be noticed both via microscopy and rapid detection exams (RDTs), the 2 widespread exams for detecting the agent in malaria patients‘ blood. The detected of the infection can be done using various sensitive assays, as via molecular Polymerase Chain Reaction (PCR) and LAMP theqnique [3].

TRANSMISSION

Vectors: various Plasmodium species may involve in the spread of these parasites, as vectors and intermediate hosts, as discussed below

- Culex
- Anopheles,
- Culiceta
- Mansonia and
- Aedes
- Bites of mosquitoes,

Robotically with the aid of blood switch as in mass vaccination, Injection and Caponization Anopheles mosquitoes are the causative agent which malaria parasites are spread from person to person. The blood that contains the parasites enters the mosquito's gut when it bites. The parasites go through a difficult transformation over ten or more days, with the mature parasite eventually settling into the salivary glands of the mosquito and becoming ready to spread to a new host when it bites again. The parasite first enters the liver of the next human host, then it multiplies quickly in this spot for at least five days before moving on to infect pink blood cells. The most severe symptoms of malaria are caused by parasites in the blood, including cerebral malaria, which is brought on by parasitized blood cells obstructing blood capillaries in the brain.

Human-to-human transmission of Malaria

Malaria can be spread from one man or woman to another through organ transplant, sharing of syringes and needles, and blood transfusion since the parasite is present in human red blood cells. Inherited malaria is the term for the possibility that an inflammatory mother could transmit malaria to her unborn child during childbirth [2].

LIFE CYCLE

Life cycle begins when the female Anopheles mosquito ‗Sporozoites' injected that is the parasite form while taking the meal of blood

Pre-Erythrocytic Schizogony

The curved and thread with tapered ends sporozoites, extended nucleus contribution the Liver cells and grow to be ‗Merozoites' in pre-erythrocytic Schizogony P. Falciparum completed in six days, in P. Malariae 15 days, P. Ovale, 9 days, and the P. Vivax using eight days of incubation period.

Erythrocytic Schizogony

The parasite-filled hepatocytes rupture, liberating merozoites that target red blood cells (RBC). (Blood stays sterile during pre-erythrocytic degree, the and there are no pathological or clinical symptoms).

At this stage, the parasites infiltrate the red blood cell and tolerate the ensuing morphological fluctuations.

Trophozoites

Trophozoites are identifiable by their blue cytoplasmic rings, red nuclear mass, unstained "nutrient vacuole," and active amoeboid motility. Granules of pigment, which stand in for metabolic products, arise.

The trophozoite of Falciparum is affixed to the edge of the host RBC. "Maurer's dots" are pigment particles either in the form of dark brown or black.

Schuffner's granules'

P. vivax, the red blood cell swells to double its initial size. Yellow specks make up the pigment; they resemble basophilic stippling. It is referred to as "Schuffner's granules" and is brown in hue.

Ziemann's granules

The trophozoite in P. malariae spreads like a band throughout the infected red blood cell. "Ziemann's granules" are granular, black pigment particles.

PATHOGENESIS

First, by surface determinant of P. falciparum known as erythrocyte membrane protein 1 (EMP1), parasitized RBCs cling to receptors present on intercellular adhesion molecule 1 (ICAM1). Parasite

glycosylphosphatidylinositol (GPI), which is one or the other discharged into the blood or present in parasite membranes, acts as a pathogen-associated molecular pattern (PAMP) and toxin when PRBCs released the merozoites four hours later, thereby eliciting an inflammatory response. After that, there is a local acute-phase response that includes endothelium activation, local cytokine and chemokine secretion, and endothelial cell upregulation of cell-adhesion molecule expression. This cycle is repeated and made worse during the course of the following day due to an increase in parasite population and more attachment of with endothelial cells of PRBCs that express cell-adhesion molecules in an uncontrolled manner.

Additionally, GPI can activate CD1d-restricted natural killer T (NKT) cells by acting as a ligand for them. Activation and participation of CD4+ T cells occur because activated NKT cells have the ability to control the development of CD4+ T cells into T helper 1 (TH1) or TH2 cells, depends upon the expression of type loci present of natural killer complex. Furthermore, chemokines attract monocytes and stimulate neutrophils (however it is unknown for neutrophils to enter brain microvessels in cerebral malaria-stricken humans or mice). This cycle is repeated and made worse during the course of the following day due to an increase in parasite population and more binding of PRBCs to endothelial cells that express cell-adhesion molecules in an uncontrolled manner. Additionally, GPI can activate CD1d-restricted natural killer T (NKT) cells by acting as a ligand for them. Activation and participation of CD4+ T cells occur because activated NKT cells have the ability to control the development of CD4+ T cells into T helper 1 (TH1) or TH2 cells, depending on which natural killer complex loci are expressed.

SIGN AND SYMPTOM

In humans, the unexpected coldness, rigor, fever, and sweating-occurs every day in cases of P. vivax and P. Ovale infections and every 3 days (tertian fever) in cases of P. malaria. P. Falciparum infection might result in a less common but nearly constant 14-day fever or a recurring fever every 36-48 hours (quartan fever). The symptoms of malaria generally start 8-5 days succeeding infection; symptoms consist of.

Decrease in focus

Prevents the person from walking;

The inability to eat

Low blood pressure, defined as 50 mmHg in children and significantly less than 70 mmHg in adults.

breathing issues

Shock to the circulation

Bleeding issues or hemoglobin levels below 5 g/dl; • Kidney failure or hemoglobin in the urine

PREVELANCE

One of the endemic regions for Plasmodium (P.) falciparum and P. vivax is Pakistan. Roughly 150 million people reside in areas where malaria is endemic. In Pakistan, malaria transmission is seasonal and prone to epidemic breakouts in Sindh, Baluchistan, and Khyber Pakhtunkhwa (KP). After the rainy season, September through November is when malaria is most commonly transmitted. There is a brief springtime transmission season (March–April), however the majority of springtime cases are thought to be relapsing P. vivax malaria or infections acquired during the monsoon that manifested later than expected.

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P. Vivax makes up 75% of the malaria burden in Pakistan overall, whereas P. Falciparum accounts for 25%. • A parasite stage present in the blood of more than 2% Malaria claims the lives of 50,000 people in Pakistan each year, with 500,000 new cases reported. Comparatively speaking, P. Vivax is responsible for 88% of malaria infections, while P. Falciparum usually garners more attention because to its severity.
Among 435 clinically suspected cases of malaria under Nawab Shah, 114 patients (33.1%) were found to have P. Falciparum present (Memon, 1997).
PROBLEM STATEMENT
Little data is available on the prevalence of mixed malaria infection and should not be ignored as we know their serious health consequences. We want to investigate the prevalence of Mix malaria infection in KP region
AIMS AND OBJECTIVES OF THE STUDY
The current aim to investigate the prevalence of mixed malaria infection (P. falciparum and P. vivax).
Objectives of the study
To check the prevalence of (P. vivax, P. falciparum and mix malaria infection) in people coming to different hospitals of KPK.
To check the mix malaria infection in various districts of Khyber Pakhtunkhwa.

MATERIA AND METHODS
Study Design:
Retrospective cross-sectional
Study Settings:
The study was conducted in the following hospitals of KPK.
District Headquarter Hospital (DHQ) Karak.
Khalifa Gul Nawaz Hospital (KGN) Bannu.
District Headquarter Hospital (DHQ) Buner.
Duration of Study:
6 months after the approval of from the undergraduate committee of Allied Health Sciences (AHS), INU
Sample Size:
Secondary data was collected from the hospital setup.
Sampling Technique:
Random sampling techniques.
Sample Selection:
All the gender with all age groups were included in the current study.
Inclusion Criteria:
All ages, all genders with all occupation having sign and symptoms of malaria.
Exclusion Criteria:
If the patient is not willing to record his or her data would not be included. Uncooperative patients were excluded.

Data Collection Procedure

Suspected samples of blood were collected from patient having symptom of malaria during April–July 2024 at malaria clinics in District Headquarters Hospital (DHQ Karak), Khalifa Gul Nawaz Hospital (KGN Bannu), District Headquarters Hospital (DHQ Buner) sites.

Microscopy and RDTs were performed.

Microscopy analysis were done via thick and thin blood smears and blood collected through finger prick and venous blood

These were air-dry.

Fixation was done using methanol.

Stained with Giemsa

Before a sample was considered negative, thick blood smear fields were examined at a magnification of 100× using an oil immersion lens. Counting the number of parasites versus 200 leukocytes allowed researchers to quantify parasite density using thick blood smears. On samples where the RDT test had a negative result, microscopy was also conducted. A senior lab technician cross-checked the blood smears. RDT was conducted in accordance with the manufacturer's instructions. Repeated for tests that yielded inconsistent findings (microscopy positive, RDT negative, for example).

Data Analysis Procedure

Data were analyzed using excel 2016 by finding prevalence of mixed malaria infection. Graphs and tables were made to arrange the data.

RESULTS

In this study overall three different districts (Buner, Bannu and Karak) of KP were evaluated for the Presence of mixed malaria infection and data from 3 years previously present in the hospital was studied.

Prevalence of malaria falciparum, malaria vivax and mixed malaria infections during 2021 in Buner

Out of a total of 11487 patients, 82 (0.71%), were positive for PF, 416 (3.62%) PV, while mix infection PF+PV were observed in 10 (0.087%) patients, most of the mix infection was observed on September 5 (50%). Overall, 511 were positive individually for PV and PF, rest of the details are shown in Figure 4.1.

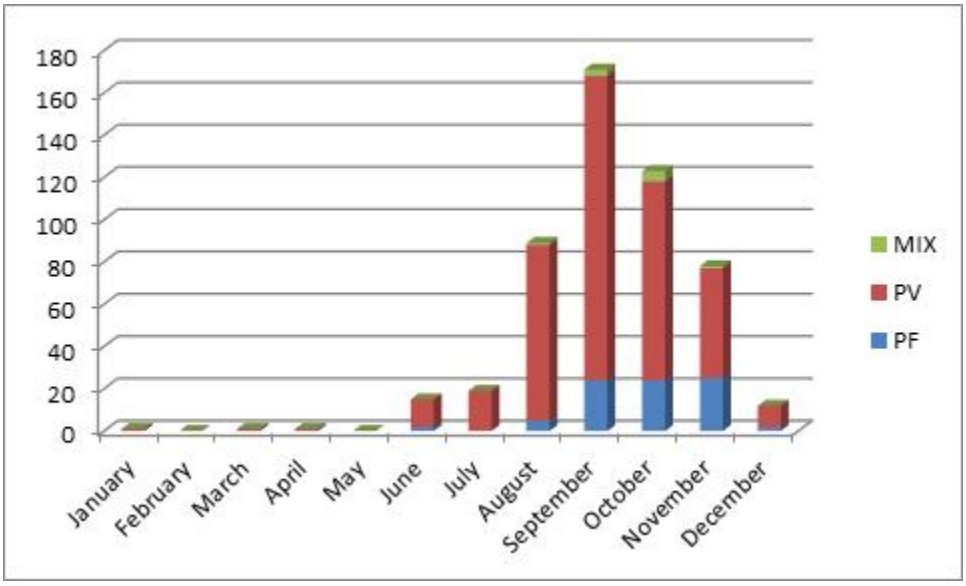


Figure 4.1; shows the prevalence of Malaria (PV, PF and PV+PF) during 2021 in banner region

Prevalence of malaria falciparum, malaria vivax and mixed malaria infections during 2022
Out of a total of 11487 patients, 91 (0.57%), were positive for PF, 1070 (%) PV, while mix infection PF+PV were observed in 18 (%) patients, most of the mix infection was observed on September 8 (%). Overall, 1179 were positive individually for PV and PF, rest of the details are shown in Figure 4.2.

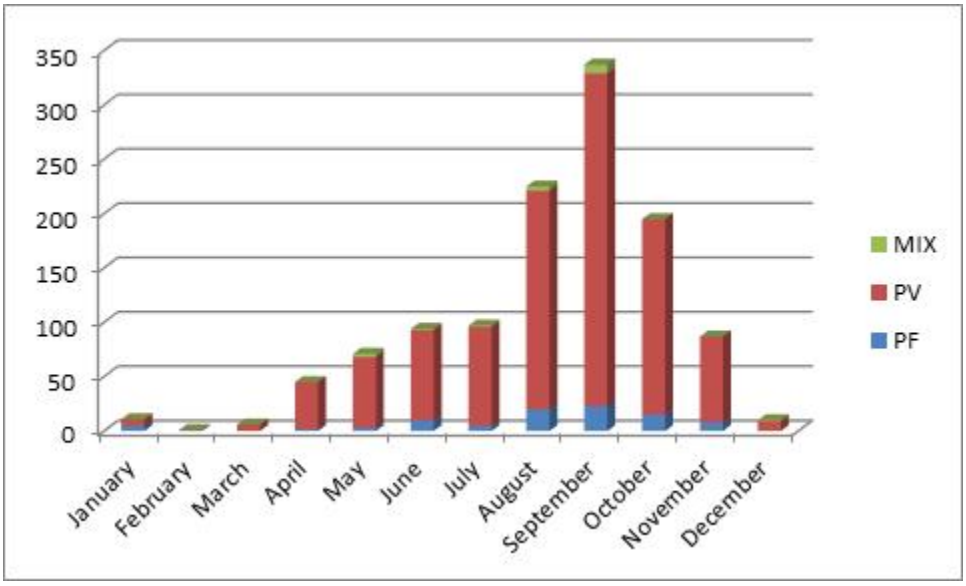


Figure 4.2; shows the prevalence of Malaria (PV, PF and PV+PF) during 2022 in Buner region
Prevalence of malaria falciparum, malaria vivax and mixed malaria infections during 2023
Out of a total of 16734 patients, 60 (0.35%), were positive for PF, 1474 (8.80%) PV, while mix infection PF+PV were observed in 14 (0.08%) patients, most of the mix infection was observed in May and June 3 (21.42%). Overall, 1548 were positive individually for PV and PF, rest of the details are shown in Figure 4.3.

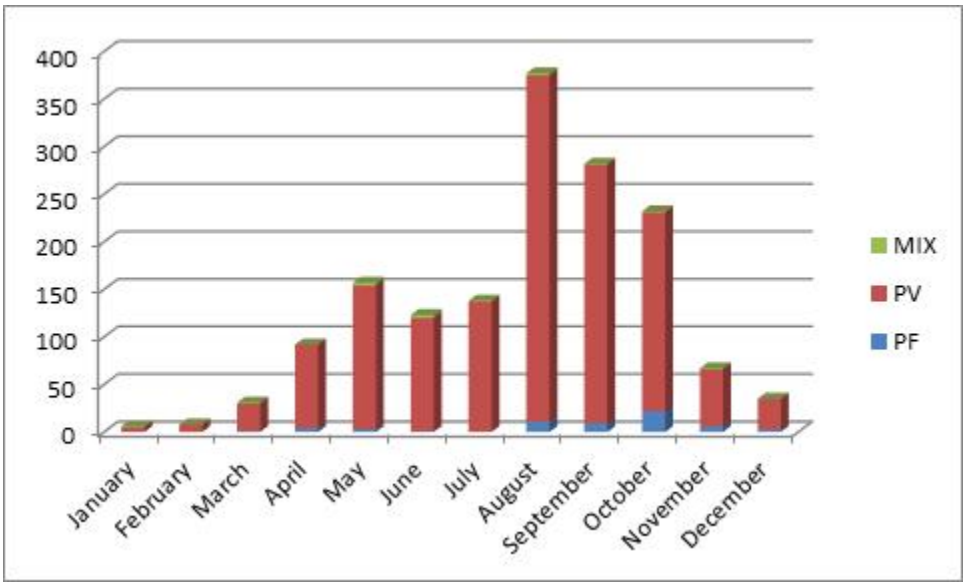


Figure 4.3; shows the prevalence of Malaria (PV, PF and PV+PF) during 2023 in Buner region

Prevalence of malaria falciparum, malaria vivax and mixed malaria infections during 2021in Bannu
Out of a total of 14839 patients, 69 (0.46%), were positive for PF, 2127 (14.33%) PV, while mix infection PF+PV were observed in 22 (0.14%) patients, most of the mix infection was observed on June 7 (31.81%). Overall, 2231 were positive individually for PV and PF, rest of the details are shown in Figure 4.4.

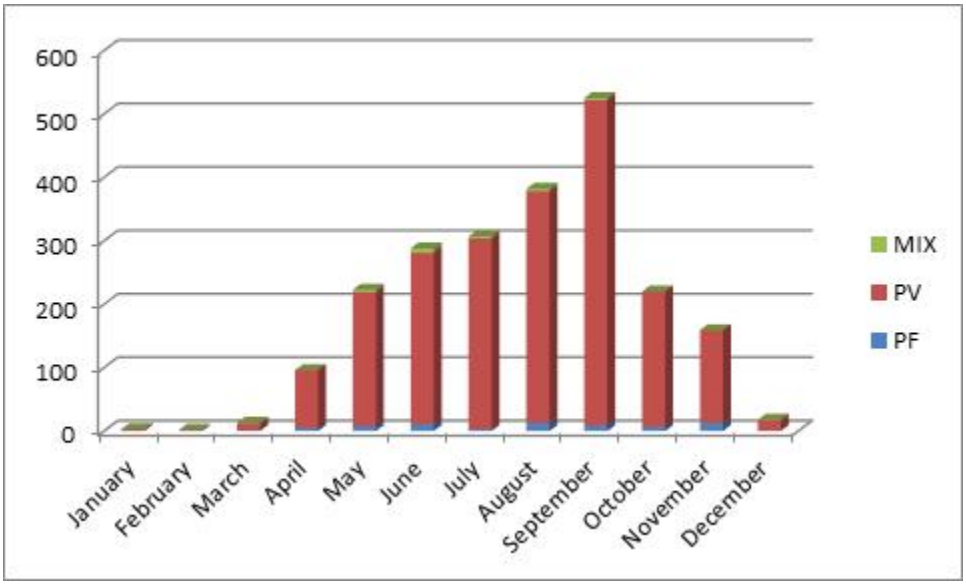


Figure 4.4; shows the prevalence of Malaria (PV, PF and PV+PF) during 2021 in Bannu region
Prevalence of malaria falciparum, malaria vivax and mixed malaria infections during 20221in Bannu
Out of a total of 14839 patients, 114 (0.76%), were positive for PF, 2593 (17.47%) PV, while mix infection PF+PV were observed in 29 (0.195%) patients, most of the mix infection was observed on June 8 (27.5%). Overall, 2753 were positive individually for PV and PF, rest of the details are shown in Figure 4.5.

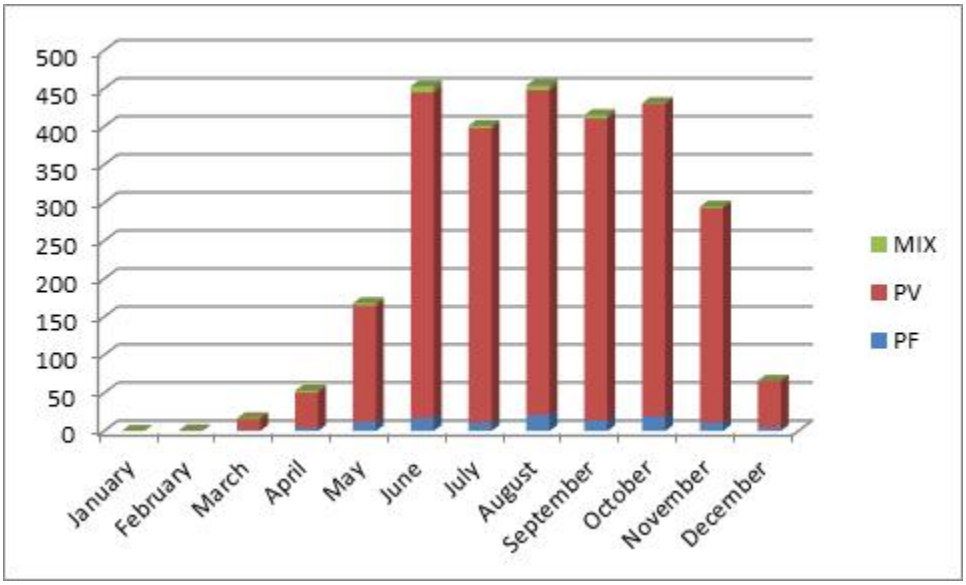


Figure 4.5; shows the prevalence of Malaria (PV, PF and PV+PF) during 2022 in Bannu region

Prevalence of malaria falciparum, malaria vivax and mixed malaria infections during 2023 in Bannu
Out of a total of 15452 patients, 86 (0.55%), were positive for PF, 2450 (15.85%) PV, while mix infection PF+PV were observed in 25 (0.16%) patients, most of the mix infection was observed on September 7 (28%). Overall, 2570 were positive individually for PV and PF, rest of the details are shown in Figure 4.6.

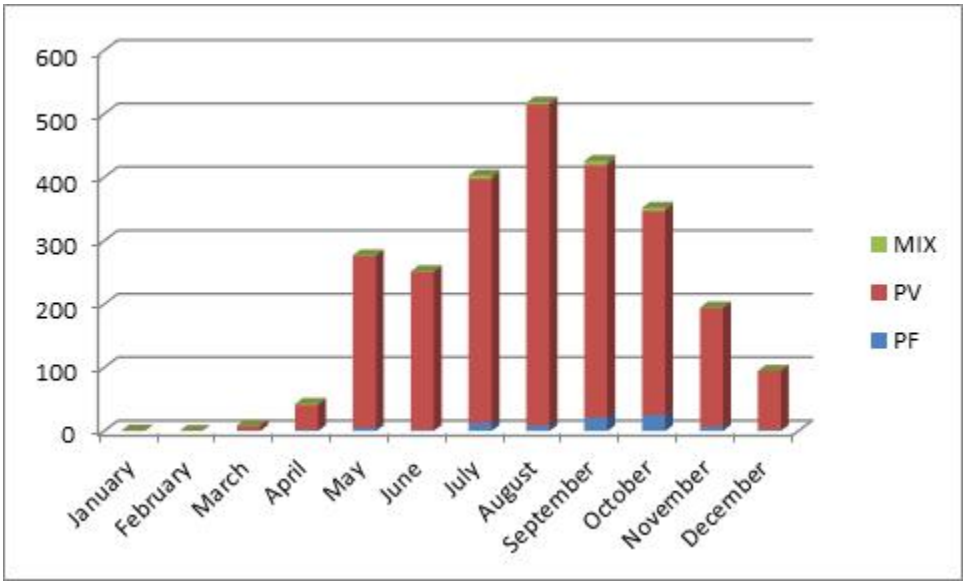


Figure 4.6; shows the prevalence of Malaria (PV, PF and PV+PF) during 2023 in Bannu region
Prevalence of malaria falciparum, malaria vivax and mixed malaria infections during 2021in Karak
Out of a total of 67235 patients, 235 (0.34%), were positive for PF, 4630 (6.88%) PV, while mix infection PF+PV were observed in 26(0.038%) patients, most of the mix infection was observed on May 7 (26.92%). Overall, 4891 were positive individually for PV and PF, rest of the details are shown in Figure 4.7.

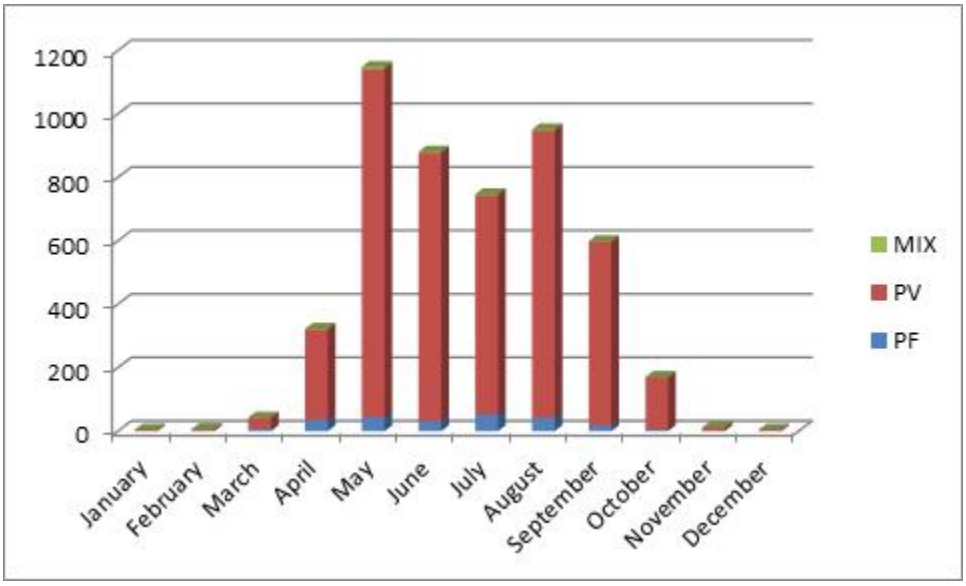


Figure 4.7; shows the prevalence of Malaria (PV, PF and PV+PF) during 2021 in karak region

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Prevalence of malaria falciparum, malaria vivax and mixed malaria infections during 2022 in Karak

Out of a total of 100430 patients, 316 (0.31%) were positive for PF, 7873 (7.8%) PV, while mix infection PF+PV were observed in 21(0.02%) patients, most of the mix infection was observed on May 4 (19.04%). Overall, 8210 were positive individually for PV and PF, rest of the details are shown in Figure 4.8.

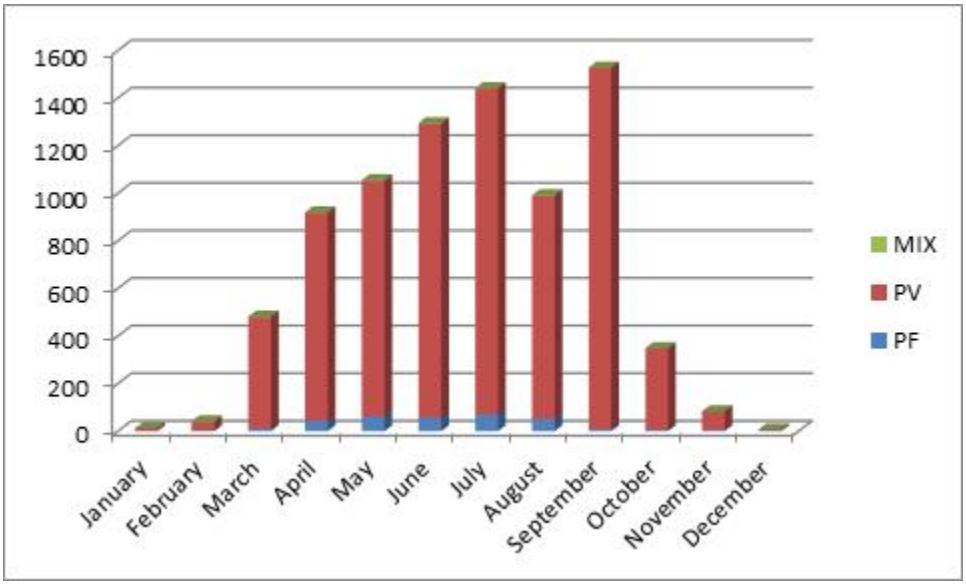


Figure 4.8; shows the prevalence of Malaria (PV, PF and PV+PF) during 2022 in karak region

Prevalence of malaria falciparum, malaria vivax and mixed malaria infections during 2021-2023 in Karak, Bannu, and Buner

The Plasmodium vivax was found more as compared to plasmodium falciparum, as shown in Table 4.1. And the overall mixed infection was found in Bannu, the rest of the details are shown in Table 4.1.

Table 4.1: Prevalence of malaria falciparum, malaria vivax and mixed malaria infections during 2021-2023 in Karak, Bannu, and Buner.

S.No	PV	Frequency	%	PF	Frequency	Percentage	Mix (PV+PF)	Frequency	%	Total
Karak 2021	4630	67235	6.88	225	67235	0.34	26	26	0.038	4891
2022	7813	100430	7.8	316	100430	0.31	21	21	0.02	8210
2023	12001	114921	10.44	881	114921	0.76	176	176	0.153	13058
Bannu										
2021	2127	2231	14.33	69	2231	0.46	22	22	0.14	2231
2022	2593	2753	17.47	114	2753	0.76	29	29	0,195	2753
2023	2450	2570	15.85	86	2570	0.55	25	25	0.16	2570
Buner										
2021	416	511	3.62	82	511	0.71	10	10	0.087	511
2022	1070	1179	6.76	91	1179	0.57	18	18	0.11	1179
2023	1474	1548	8.8	60	1548	0.35	14	14	0,08	1548

DISCUSSION

Malaria kills hundreds of thousands of people globally, particularly pregnant women and children under five [10]. It is the world's fifth greatest cause of the death, and 1.5 million malaria cases in Pakistan annually reported by WHO and 3 nations in the Eastern Mediterranean Region include Pakistan, which accounts for 95% of the malaria cases in the region [11]. The WHO 2021 study states that Pakistan reduced case incidence in 2020 compared to 2015 by at least 40%. Pakistan, however, continued to rank among the top four nations in the region for most predicted cases of malaria (56%) in 2020 [10]. In this study the prevalence of malaria in three different districts was observed. Our study percentages are different from other studies as previously reported from Pakistan. As in Pakistan from various cities such as Punjab (0.2%), the FATA region (19%), Baluchistan (17%), and KP (19%) were the provinces in Pakistan with increased rates of malaria infection in 2018 [12]. Because there is insufficient data available. Malaria parasite species are unevenly distributed and vary in frequency according to the seasons in Pakistan due to the country's harsh climate, which is experienced during all four seasons [13]. The diagnosis of malaria is frequently made by looking at microscopic slides. When microscopic detection is not achievable or in remote places during migrant outbreaks, the fast diagnostic test is typically utilized.

According to a meta-analysis carried out in 2021, the prevalence of malaria in Thailand and India was found to be 35% and 8%, respectively [14]. Further research led to the completion of meta-analyses in Afghanistan, Iran, and China, revealing that malaria has expanded there as well, with I2 values of 83.3% [15], 63% [16], and 9% [17], these studies are not in accordance with the current study as various percentage of PM, PV and PV+PF was recorded, this variation may be due to sample size, the geographical location and the availability of insect control programs.

In this comprehensive review and meta-analysis, mixed infection was found in just 16 out of 45 investigations. D.I. Khan and Khuzdar showed mixed infection estimates of 0.10 percent and 17.0 percent, in the case of mixed infection from Karak our study also reported the mixed infection in 0.1% of cases. However, according to this study, Pakistan's most common malaria Parasite now is mixed infection [18]. As in the current study the mixed malaria infection in Bannu was observed in 0.46% of patients, which is close to the above study findings. Nearly 87% of malaria episodes in this study from Pakistan's tribal parts of KPK were caused by P. vivax [19], this study is not in accordance with the current study as 10% of malaria cases were reported. A study carried out in the hilly areas of tribal districts found that in March, P. falciparum infections were lowest and P. vivax cases were greatest, and in October, the opposite trend was observed. It was projected that the influx of Afghan migrants into Iran and Pakistan's Baluchistan area increased the incidence of malaria infections by 24–36% [20]. According to Mohammad and Hussain (Muhammad and Hussain, 2003), 6.86% of Buner general population had positive cases of malaria. More people were notified about P. vivax (5.78%) than P. falciparum (1.08%). [21]

CONCLUSIONS

Out of a total of 11487 patients, 82 (0.71%), were positive for PF, 416 (3.62%) PV, while mix infection PF+PV were observed in 10 (0.087%) patients in Buner 2021, mixed infection was mostly found in September.

In 2022, 91 (0.57%), were positive for PF, 1070 (%) PV, while mix infection PF+PV were observed in 18 (%)

Out of a total of 16734 patients, 60 (0.35%), were positive for PF, 1474 (8.80%) PV, while mix infection PF+PV were observed in 14 (0.08%) patients, most of the mix infection was observed in May and June 3 (21.42%).

In Bannu, out of a total of 14839 patients, 69 (0.46%), were positive for PF, 2127 (14.33%) PV, while mix infection PF+PV were observed in 22 (0.14%) patients, most of the mix infection was observed on June 7 (31.81%).

In 2022, 114 (0.76%) were positive for PF, 2593 (17.47%) PV, while mix infection PF+PV were observed in 29 (0.195%) patients, most of the mix infection was observed on June 8 (27.5%).

Out of a total of 15452 patients, 86 (0.55%), were positive for PF, 2450 (15.85%) PV, while mix infection PF+PV were observed in 25 (0.16%) patients, most of the mix infection was observed on September 7 (28%).

In Karak, out of a total of 67235 patients, 235 (0.34%), were positive for PF, 4630 (6.88%) PV, while mix infection PF+PV were observed in 26(0.038%) patients, most of the mix infection was observed on May 7 (26.92%)

In Karak, out of a total of 100430 patients, 316 (0.31%), were positive for PF, 7873 (7.8%) PV, while mix infection PF+PV were observed in 21(0.02%) patients, most of the mix infection was observed on May 4 (19.04%).

In Karak, out of a total of 114921 patients, 881 (0.76%), were positive for PF, 12001 (10.44%) PV, while mix infection PF+PV were observed in 176 (0.153%) patients, most of the mix infection was observed in June 31 (17.61%). The Plasmodium vivax was found more as compared to plasmodium falciparum, and the overall mixed infection was found in Bannu. The overall prevalence of mix malaria infection was predominant in Bannu followed by Karak and Buner.

LIMITATIONS

Due to limited time, and limited resources the sample size was 377 patients from three hospitals in different districts of Khyber Pakhtunkhwa. The process of ethical approval from the hospitals was lethargic. Other than that, everything went smoothly thanks to the group members' efforts and the oversight side.

RECOMMENDATION

According to WHO Mefloquine is advised for nursing moms visiting places where there is a chance of malaria resistant to chloroquine. Additionally, the full pediatric dosages of the relevant antimalarial should be given to breastfed babies. Travelers who want to get pregnant after visiting a malaria-risk area and who prefer to do it with the least amount of medication should wait the following intervals after stopping the antimalarial medication before trying to get pregnant. It is advised to take mefloquine for three months, doxycycline for one week, and atovaquone/proguanil for at least two to three weeks.

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