Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/jptcp.v30i18.3189

STATISTICAL ANALYSIS OF MALARIAL PARASITES IN HUMAN POPULATION OF DISTRICT MARDAN KHYBER-PAKHTUNKHWA PAKISTAN.

Fazl Ur Rahman[1], Muhammad Fawad[1], Inayat Ullah[2]*, Farhat Sunny[1], Shabir Ahmad[1], Muazzam Ali Khan[5], Talha khan[4], Alamgir Khan[3], Muhammad Adnan[5], Muhammad Talha[4], Asad Ullah Jarar[2,6], Aqsa Riaz[6].

[1] Department of Zoology, Islamia College University Peshawar Pakistan.
[2] Department of Zoology, Bacha Khan University Charsadda Pakistan.
[3] Department of Animal Sciences, Quaid-I-Azam University Islamabad Pakistan.
[4] Department of Zoology, Quaid-I-Azam University Islamabad Pakistan.
[5] Department of Botany Bacha Khan University Charsadda Pakistan.
[6] Department of Zoology, Wildlife & Fisheries PMAS Arid Agriculture University Rawalpindi Pakistan.

***Correspondence author:** Inayat Ullah*
*Email: inayatullahafridi2018@gmail.com

ABSTRACT:
A mosquito serves as the illness's primary vector, and the genus Plasmodium's intracellular protozoan parasites invade red blood cells to generate the systemic vector-borne disease known as malaria. Due to its potential for fast progression to complications and mortality in the absence of quick and effective treatment, malaria is a medical emergency. The majority of factors that induce severe malaria include *Plasmodium falciparum*. A female Anopheles mosquito that is feeding infects the human host by injecting the parasites. The four species of Plasmodia that may infect people are *P. falciparum*, *P. vivax*, *P. ovale*, and *P. malariae*. Among the four species, *P. falciparum* is the main species that causes severe disease and mortality. The second most lethal illness in the world is malaria. More than 300 million people are infected by the infectious disease each year, and it claims 1.5 to 2.7 million lives. A kid dies from the infectious illness every 30 seconds, or an estimated one million children under the age of five every year. About half of the world's population is at risk from malaria, and more than 1 million children die each year from its consequences. When mosquitoes that contain the malaria parasite bite and infect humans, the disease is spread. Malaria causes low birth weight (below 2500g) in pregnant women who are not treated, which can result in a variety of disabilities such as cerebral palsy, mental retardation, and cognitive deficiencies. In district Mardan this disease is more prevalent in males than females. From pathology Department Mardan medical complex 230 Blood samples were obtained, and thick and thin slides produced of them. for all individuals and studied its microscopy 23 Positive cases were found out of 230 blood samples. In these 230 blood samples *Plasmodium vivax* were found 16 (6.9%) and *Plasmodium falciparum* were found 7 (3.04%) and no mix infection was found. In 230 blood samples there were 15 (6.5%) males and 8 (3.4%) females which were infected by malarial parasite. In 15 infected males there were 11 (73.3%) *P.vivax* and 4 (26.6%) were *P.falciparum.* Also in 8 infected females there were 5 (62.5%) *P.vivax* and 3 (37.5%) were *P.falciparum.* In both males and females *P.vivax* were found more than *P.falciparum*. Month wise samples were collected and its prevalence was studied. Different age groups were made and

malaria prevalence was studied in them. 5 years or less than 5 years group was not included. Malaria disease was found more in age group from 6 years up to 15 years.

Keywords: Malaria, Protozoan, Vector, Endemic, Prevalence, Plasmodium vivax, Plasmodium falciparum.

1. INTRODUCTION

Malarias symptoms were described in the 5th century BC by Hippocrates [1]. The name malaria is derived from the mediaeval Italian term "mala aria," meaning bad air, the cause of malaria was thought due to smell of anaerobic bacteria in saline mud in marshes [2]. The term malaria comes from 'mal' 'aria', or bad air, which is caused by protozoan parasites of the genus *Plasmodium* and is transmitted to human beings by female *Anopheles mosquito*. [3]. Different Species of Plasmodium cause malaria in vertebrate hosts, from snakes and birds to mice and humans. *P. berghei*, *P. yoelii* and *P. chabaudi* are commonly used mouse malaria species, everyone has unique properties and used in different fields of study. Murine malaria species is genetically controlled; and technology present for *P.berghei* [4]. 108 nations have an endemic malaria problem. 90% of the reported 243 million illnesses and 863,000 fatalities in 2008 were in Africa. The danger of contracting malaria varies greatly throughout the globe. Citizens of sub-Saharan Africa and India are most at danger since these regions see the highest rates of transmission and yearly mortality worldwide. Conversely, South America, China, Mexico, and Middle Eastern nations, which experience fewer annual cases, are low-risk regions [5]. The global burden is highly less capable due to the general difficulties of monitoring diseases in developing countries therefore, some people do not use formal health systems, due to living in rural areas or having a no confidence in diagnostics. At the national level, monitoring of malaria is particularly difficult because the transmission intensity and seasons differs across Geographical areas and from year to year [6].

Research has greatly improved our knowledge about malaria and its Epidemiology. Beneficial improvement has occurred in the control of malaria which have been noticed in different African endemic countries in past [7]. These improvements have been developed to enhance collecting of money for malaria control. Improved diagnosis and treatment cases with artemisinin-based therapies (ACTs) or other highly effective drug combinations enhanced prevention such as insecticide treated nets (ITNs), indoor residual spraying (IRS), and intermittent preventive therapy (iPTP) during pregnancy [8]. There is increasing concern that these achievements could be lost if present drugs and insecticides lose their function [9]. Malarial Patients present due to every 48 to 72 hours, contaminated red blood cells burst, causing a high fever (depending on the species of Plasmodium). Vomiting, diarrhea, and severe anemia are possible symptoms of this. According to the species and the individual, infection intensity varies. Malaria can, in extreme situations, result in brain and central nervous system issues as well as liver failure and fits. These issues are linked to cerebral malaria (CM), a condition in which parasites isolate in the brain and block blood vessels, sometimes leading to coma [10].

2. MATERIALS AND METHODS:

2.1. Sampling Processing

A total number of 230 blood samples were collected from general human's population of District Mardan. Blood samples were collected from Tehsil and District Mardan. This sampling was randomly taken with respect, male and female were included. Selection included healthy and diseased individuals. This study was conducted in patients having malarial symptoms; visiting to Mardan Medical Complex Mardan (MMCM). Map of the selected district is given in figure 1.

2.2. Materials

Glass slides, sterilized pickers, spirit, microscope and distilled water, methanol, Geimsa stain were used during lab work.

2.3. Method

In practical activity the names of individuals were noted in a register with their age under five years were not included and higher aged individuals were included in research, both sexes were included in sampling, Blood from individuals having malarial symptoms were used and then thick as well as thin smears of blood were made. In thin smear we examine the species of *plasmodium* while thick smear is used for the detection of the parasite under microscope. Two types of plasmodium species were common at MMCM malarial patients; *plasmodium vivax* and *plasmodium falciparum.* we noticed both negative and positive individuals, in total number of samples 230, out of which 207 were Negative and 23 were positive. Negative results were more than positive.

3. RESULTS:

3.1. Overall Prevalence.

A total of 230 blood samples were taken randomly that include 150 males and 80 females. Out of these 230 samples 23 were found positive for malaria parasite and 207 were negative, and no mix infection was found. Table 1 and figure 2 shows overall prevalence of malarial parasites. Total 230 samples were taken randomly, 23 were found positive and 207 were found negative out of these 230 samples, 16(6.95%) were *plasmodium vivax,* and 7(3.04%) were *plasmodium falciparum.* Details are given in table 1 and figure 2.

3.2. Gender wise Prevalence of *P.Vivax* and *P.falciparum*.

Table 2 and figure 3 shows total male and total female results. Out of 150 males 15 were positive and out of 80 females 8 were positive. Out of 150 positive males' cases *plasmodium vivax* were 11(7.3) *plasmodium falciparum* were 4(2.6) and mix infection was not found. While out of 80 positive females' cases *plasmodium vivax* were 5(6.25) *plasmodium falciparum* were 3(3.75) and no mix infection was found. Overall malaria was more prevalent in males than females.

3.3. Month wise Prevalence of Malaria in Males.

Table 3 and figure 4 shows prevalence of malaria in males during November 2021 to May 2022. In November 20 samples were taken from males out of these 20 samples1 (5%) was found positive, in December 20 samples were collected out of which 1 (5%) was found positive. In January 10 samples were taken out of which 2 (20%) were found positive, in February 15 samples were taken out of which 1(6.6%) was found positive, in March 15 samples were taken out of which 2 (13.3%) were found positive, in April 30 samples were taken out of which 3 (10%) were found positive and in May 40 samples were found out of which 5 (12.5%) were found positive.

3.4. Month wise Prevalence of Malaria in Females.

Table 4 and figure 5 shows prevalence of malaria in females during November 2021 to May 2022. In November 5 samples were taken out of which 1(20%) was positive, in December 5 samples were taken out of which 1 (20%) was found positive, in January 8 samples were taken out of which 1 (12.5%) was found positive, in February 14 samples were found out of which 1 (7.1%) was found positive, in March 20 samples were taken out of which 1(5%) was found positive, in April 8 samples were taken out of which 2 (25%) were found positive and in May 20 samples were taken out of which 1(5%) was found positive.

3.5. Age Groups wise Prevalence of Malaria in Males.

Table 5 and figure 6 shows Groups of Ages, total samples and percentage of positive cases in males. There are 9 groups of different ages of males. Group 1included age 6-10 years, group 2, 11-15 years, group 3,16-20 years, group 4,21-25 years, group 5, 26-30 years, group 6, 31-35 years, group 7, 36-40 years, group 8, 41-45 years, group 9, 46-50years. Group first included 35 samples out of which 4 cases were positive. Group second included 28 samples out of which 2 cases were positive. Group third included 22 samples out of which 2 cases were positive. Group fourth included 20 samples out of which 1 case was positive. Group fifth included 15 samples out of which 2 cases were positive.

Group sixth included 10 samples out of which 1 case was positive. Group seventh included 5 samples out of which 1 case was positive. Group eighth included 9 samples out of which 2 cases were positive and group ninth included 6 samples in which no positive case was found.

3.6. Age Groups wise Overall Prevalence of *P.Vivax* and *P.falciparum.*

Table 6 and figure 7 shows overall Age groups, all positive cases and number of malarial parasites; *plasmodium vivax* and *plasmodium falciparum.*

4. FIGURES AND TABLES

Figure 1: Map of Mardan KPK Pakistan.

Table 1: Shows overall prevalence of malarial parasites

No. of Total Slides Examined	No. of +ve Slides	No. of –ve Slides	No. of *P.Vivax* N (%)	No.of *P.falciparum* N (%)
230	23	207	16 (6.95)	7 (3.04)

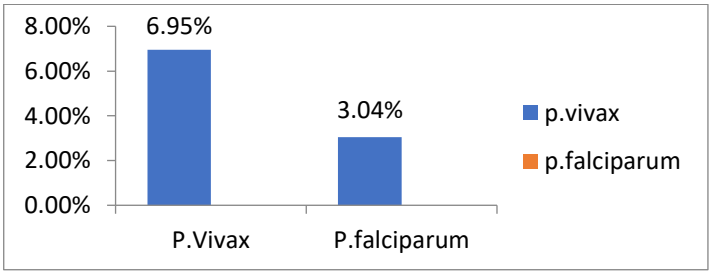

Figure 2: Shows overall prevalence of malarial parasites.

Table 2: Shows gender wise prevalence of *P.vivax* and *P.falciparum*.

Gender	No. of Total Slides Examined	No. of +ve Slides	%age of *P.Vivax* N (%)	%age of *P.falciparum* N (%)
Male	150	15	11 (7.3)	4 (2.6)
Female	80	8	5 (6.25)	3 (3.75)

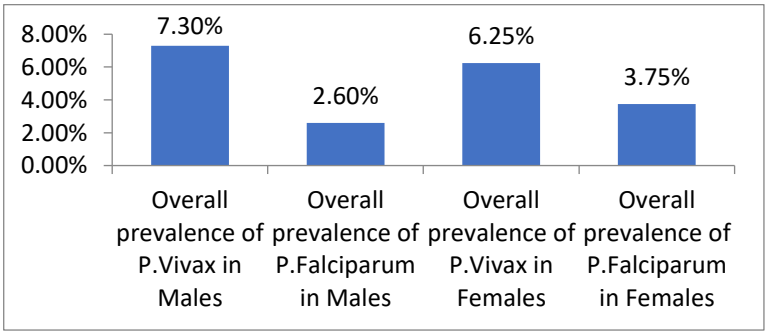

Figure 3: Shows gender wise prevalence of *P.vivax* and *P.falciparum*.

Table 3: Shows prevalence of malaria in males during November 2021 to May 2022.

Months	No. of Total Males	No. of Positive Cases	%age of +ve Cases
November	20	1	5%
December	20	1	5%
January	10	2	20%
February	15	1	6.6%
March	15	2	13.3%
April	30	3	10%
May	40	5	12.5%

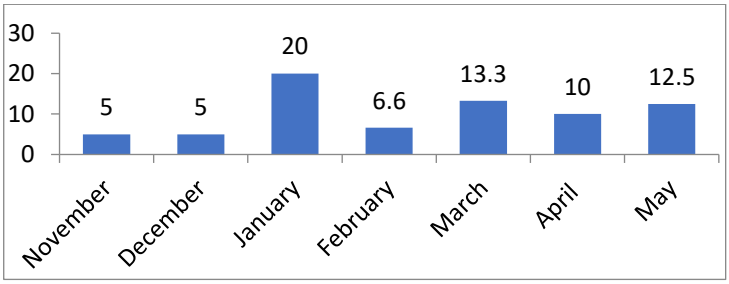

Figure 4: Shows Month wise prevalence of Malaria in Males.

Table 4: Shows Age groups wise prevalence of malaria in females.

Months	No. of Total Females	No. of Positive Cases	%age of +ve Cases
November	5	1	20%
December	5	1	20%
January	8	1	12.5%
February	14	1	7.1%
March	20	1	5%
April	8	2	25%
May	20	1	5%

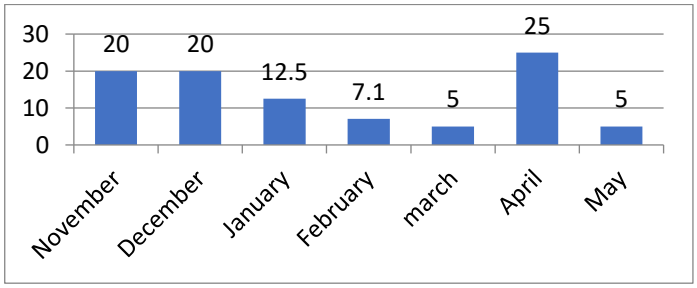

Figure 5: Shows month wise prevalence of malaria in females.

Table 5: Age groups wise prevalence malaria in Males.

Age group of Males	No. of Total Males Examined	No. of Positive Cases	%age of malarial +ve cases in Males
6-10 years	35	4	11.4%
11-15 years	28	2	7.1%
16-20 years	22	2	9%
21-25 years	20	1	5%
26-30 years	15	2	13.3%
31-35 years	10	1	10%
36-40 years	5	1	20%
41-45 years	9	2	22.2%
46-50 years	6	0	0%

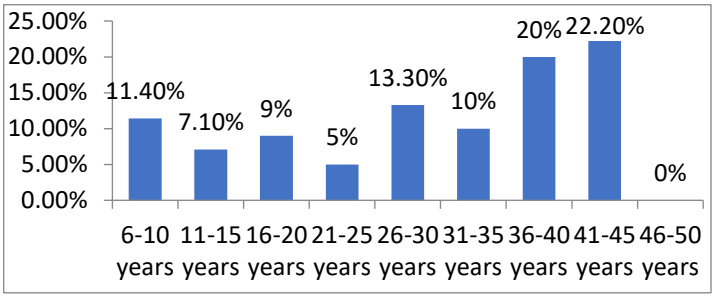

Figure 6: Shows age groups wise prevalence malaria in males.

Table 6: Shows Age groups wise Overall prevalence of *P.Vivax* and *P.falciparum.*

Overall Age groups of Males and Females	No. of Total +ve cases	No. of *P.vivax*	No.of *P.falciparim*
6-10 years	4	3	1
11-15 years	4	2	2
16-20 years	4	3	1
21-25 years	2	1	1
26-30 years	1	1	0
31-35 years	2	2	0
36-40 years	2	1	1
41-45 years	2	1	1
46-50 years	2	2	0

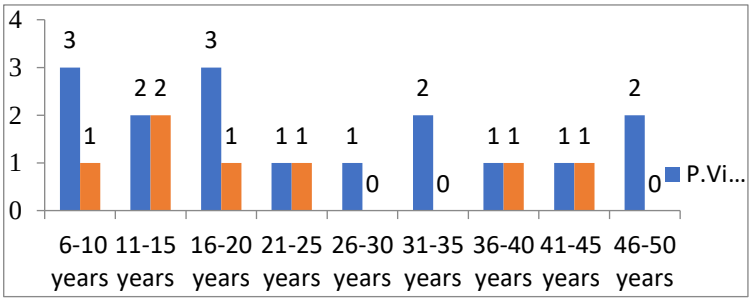

Figure 7: Shows Age groups wise Overall prevalence of *P.Vivax* and *P.falciparum.*

5. DISCUSSION

Although the frequency of malaria infection varies from region to region and province to province in Pakistan, the Punjab province reports less than 10% cases with roughly 52% of the population. In the same survey, malaria cases in the Singh province accounted for nearly 30% of reported cases, while the national malaria rate was 25%. Yet, the Baluchistan province, which has a population of 5% of the nation, is responsible for over 30% of reported cases. The only types of malaria parasite that are often found are *P.falciparum* and *P.vivax* which was reported in the country but *P.vivax* was reported from Khyber Pakhtunkhwa and the FATA (Federally Administered Tribal Areas), demonstrating the need for stronger programmatic and health system improvement in these regions. was the main species, accounting for more than 70% of the malaria issue in the nation [11,12]. Hussain and Mohammad noted a significant prevalence of *P. vivax* 5.78% and 1.08% *P.falciparum* infection among the general population of human in district Buner [13] Overall prevalence has occurred due to two species of plasmodium; P.Vivax which was 69.5%, and *P.falciparum* which was 30.4%. Prevalence of *P.vivax* is higher than *P.falciparum*. in Multan research also shows that malarial infection is higher in Males than Females, as infection was studied more in Males. According to other survey it is noted that among four species of malarial parasite, *P.vivax* and *P.falciparum* are common in Pakistan [14]. For the implementation of malarial control programmed in our country accurate information is required on the prevalence of malaria. On this base we can control malaria in our country. In this research a survey is conducted at MMCM (Mardan Medical Complex Mardan) in Tehsil and district Mardan. In this survey Malaria prevalence was examined in those patients who

were cured at MMC Mardan. According to this survey prevalence was studied from November 2012 t0 May 2013.Prevalence of Malarial Infection of Males in November was 5%, in December 5%, in January 20%, in February 6.6%, in March 13.3%, in April 10%, and in May 12.5%. While Prevalence of Malarial infection in Females was noted in November 20%, in December 20%, in January 12.5%, in February 7.1%, in March 5%, in April 25%, and in May 5%. Other research shows that Overall Malaria affects about 300 million people and also causes more than one million deaths per year all over the world. Malaria caused by *P.falciparum* has high mortality because it can lead to complications such algid malaria, cerebral malaria, and renal failure [15]. The rise of malaria in sub-Sahara Africa has been widely debated and this debate is far from being settled. Explanations offered for the observed rise point to the possible effects of increased parasite resistance to the first-line drugs, increased poverty levels and decline in health care services due to budget cutbacks [16]. The current study underscores the value of local perceptions regarding variable transmission rates and the rising cases of malaria. This has the potential to influence what people do in order to reduce the risk of malaria and in reducing its impact on people in Tanzania [17].

6. CONCLUSION

Malaria affects many countries worldwide and is not simply a physical illness but also an economic and social one. There have been several attempts to manage the condition, but very few have been successful and cost a significant amount of time and money. The use of simulation enables the development of control techniques that would not have been achievable physically. To comprehend the many elements driving the transmission of the illness, various simulation models have been developed. Every febrile illness in a person who has a history of travel to a region where malaria is endemic has to be evaluated for malaria as a possible cause. Malaria's morbidity and fatality rate rise when proper diagnosis and treatment are delayed. Cerebral malaria, pulmonary edema, acute renal failure, severe anemia, and/or bleeding are the main side effects of severe malaria. Any of these issues can materialize quickly and result in mortality in a matter of hours or days. The usual approach for detecting malaria is light microscopy of blood smears; however, although being novel and promising, no microscopic diagnostic techniques are currently being developed. Everyone who has severe malaria should start receiving parenteral care right once. Nowadays, quinidine and intravenous quinine are the most often utilized drugs, while artemisinin derivatives in general are advised for the treatment of quinine-resistant conditions. *P. falciparum* infections. On the basis of the present research it can be concluded that young age individuals are more affected by malaria as they are more exposed to parasitized malaria. Malaria infection is more in lower ages of 6 to 15 years. Males are more infected than Females. *P.Vivax* and *P.falciparum* are common in District Mardan causing severe malaria. Infection was high in months of March, April and May. In both males and females malaria disease were caused more by *P.vivax*. This infection may give high loss to the individuals of District Mardan.

7. CONFLICT OF INTEREST:

The authors stated that there were no conflicts of interest present throughout the conduct of the current study.

8. ACKNOWLEDGMENT:

This research work was facilitated by department of Zoology Islamia College University Peshawar Pakistan.

9. AUTHOR CONTRIBUTION:

FUR present the idea IU supervised the research work and rest of the author helped with laboratory work, and in manuscript writing.

10. REFERENCES:

1. COX-SINGH, J., T. M. DAVIS, K. S. LEE, S. S. SHAMSUL, A. MATUSOP, S. RATNAM, H. A. RAHMAN, D. J. CONWAY AND B. SINGH., 2008 *Plasmodium* knowlesi malaria in humans is widely distributed and potentially life threatening. *Clin Infect Dis* 46: 165-171.
2. REECE, S. E. AND J. THOMPSON, 2008.Transformation of the rodent malaria parasite
3. REITER, P., 2000.From Shakespeare to Defoe: malaria in England in the Little Ice Age. *Emerg Infect Dis* 6: 1-11.
4. JANSE, C. J., J. RAMESAR AND A. P. WATERS., 2006. High-efficiency transfect ion and drug selection of genetically transformed blood stages of the rodent malaria parasite *Plasmodium* berghei. *Nat Protoc* 1: 346-356.
5. WORLD HEALTH ORGANIZATION, 2009.WHO World Malaria Report 2009.In. World Health Organization, pp.
6. . STEKETEE, R.W. AND C.C. CAMPBELL, MALAR J, 2010.*Impact of national malaria control scale-up programmes in Africa: magnitude and attribution of effects.*
7. CIBULSKIS, R. E., D. BELL, E. M. CHRISTOPHEL, J. HII, C. DELACOLLETTE, N. BAKYAITA AND M. W. AREGAWI., 2007 Estimating trends in the burden of malaria at country level. *Am J Trop Med Hyg* 77: 133-137
8. LENGELER C., 2004.*Insecticide-treated bed nets and curtains for preventing malaria* Cochrane Database Syst Rev
9. NAJERA J.A., M. GONZALEZ-SILVA., P. L ALONSO., 2011.*Some lessons for the future from the Global Malaria Eradication Programme (1955-1969).* PLoS Med.
10. ADAMS, S., H. BROWN AND G. TURNER., 2002b Breaking down the blood-brain barrier: signaling a path to cerebral malaria? *Trends Parasitol* 18: 360-366.
11. MURTAZA, G., MEMON, I.A., MEMON, A.R., LAL, M.N. AND KALLAR, N.A., 2009. Malaria morbidity in Sindh and the plasmodium species distribution. *Pakistan J. med. Sci., 25:646-649.*
12. HAYAKAWA, T., N. ARISUE, T. UDONO, H. HIRAI, J. SATTABONGKOT, T. TOYAMA, T. TSUBOI, T. HORII AND K. TANABE, 2009.Identification of *Plasmodium* malariae, a human malaria parasite, in imported chimpanzees. *PLoS One* 4: e7412.
13. YAR, H.M., K. MASOOD, A. MAQBOOL AND G.Q. MALIK, 1998. Prevalence of malarial Parasite species in Multan district. *The Professional*, 5: 183–
14. KRAUSE PJ. BEHRMAN, KLEIGMAN, JENSES. NEELSON 2003. Malaria, Plasmodium In: Textbook of Pediatrics; 17th ed, Philadelephia; W.B Saunder; p. 1049-52.
15. BASCH PF. 1999. *Textbook of International Health (2nd Edition).* New York: Oxford BHALLI, M.A. AND SAMIULLAH, 2001. *Falciparum* malaria- a review of 120 cases. *J. Coll. Phys. Surg. Pakistan,* 11: 300–3
16. NCHINDA TC 1998. Malaria: A Re-emerging disease in Africa. *Emerging Infectious Diseases, Vol. 4(3): 398–403*.
17. WINCH PJ, MAKEMBA AM, KAMAZIMA SR, LWIHULA GK, LUBEGA P, MINJAS JN AND SHIFF CJ 1994. Seasonal variation in the perceived risk of malaria: implications for the promotion of insecticide-impregnated bed nets. *Social Science and Medicine, Vol. 39(1): 63–75*.