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REVIEW

Plasmodium vivax and *Plasmodium falciparum* are Common Malaria Species in Pakistan

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Abstract— The microbes have a diverse nature, it makes human laugh and cry. Some microbes are fruitful for humans while others are harmful. Infectious diseases are a key problem in the modern world. In the last few decades, million of peoples have died from different diseases, including bacterial, viral, fungal, parasitic, etc. Among these diseases, malaria is one of the major health problems for developing countries including Pakistan. This study was undertaken to provide baseline information about the prevalence of malaria, species distribution and to contribute to the data regarding epidemiology in Pakistan. For a collection of literature, the electronic search engine was used, using different key words i.e. prevalence, species distribution, epidemiology of malaria in Pakistan, etc. The time frame of the obtained articles was from 2000 to 2014. The two species of malaria *Plasmodium vivax* and *Plasmodium falciparum* are common in Pakistan.

Keywords: Microbes, Disease, Malaria, Plasmodium vivax, Plasmodium falciparum.

BACKGROUND

The microbes have a diverse nature, it makes human laugh and cry. The efforts of human beings were continued with the day after interaction with microbes to control and eradicate the microbes which cause diseases. Some microbes are fruitful for humans others are harmful. Infectious diseases are a key problem for the modern world. The scientist has reached to the moon, and research is still in progress. But still in this modern area, infectious diseases were stolen peace of the world. In the last few decades, million of peoples are died from different diseases, including bacterial, viral, fungal, parasitic, etc. As compare to developed countries, the ratio of the disease was found high in the undeveloped countries. In tropical countries include Pakistan, the malaria is still a problem. Millions of peoples infected and died from malaria every year. Four main species of Plasmodium which are responsible for causing the malaria disease include *Plasmodium falciparum* (P. falciparum), *Plasmodium malariae* (P. malariae), *Plasmodium ovale* (P. ovale) and *Plasmodium vivax* (P. vivax) (Anwar et al., 1994; Ahmad et al., 2013). This study was undertaken to provide baseline information about the prevalence of malaria, species distribution and to contribute to the data regarding epidemiology of malaria in Pakistan.

SEARCHING METHOD FOR LITERATURE

The electronic search engine was used for literature downloading. The main key words used for literature search were the prevalence of malaria in Pakistan, the prevalence of malaria in Khyber Pakhtunkhwa, frequency distribution of malaria, species wise distribution of malaria in Pakistan, etc. The time frame of the obtained articles was from 2000 to 2014.

LITERATURE REVIEW OF MALARIA IN PAKISTAN

In Pakistan, the accurate information about incidence and prevalence of malaria are very necessary to implement an effective malaria control progarm. It was clear from the available literature that epidemiological data from a different region of the country is insufficient (Khadim, 2002). This study will contribute to the epidemiology of malaria in Pakistan. Hussain et al. (Hussain et al., 2014) conducted an epidemiological study in a local population of Lal Qilla Dir (Lower) and reported 29% positive cases of malaria (97% P. vivax and 3% P. falciparum). No cases of P. malariae, P. ovale and mixed infection (P. vivax and P. falciparum) were recorded. According to Daud et al. (Daud et al., 2014), 83.33% of total suspected cases of malaria were found positive in the general population of Mithakhel District Karak. Yasinzai and Kakarsulemankhel, (Yasinzai and Kakarsulemankhel, 2013) notified 38.3% malaria positivity rate at district Panjgur in south-western Pakistan. The ratio of P. vivax was found very high as compared to P. falciparum 79.6% and 20.3% respectively. Khan et al. (Khan et al., 2013a) carried out a study in a general population of Bannu District reported that 27.1% cases were found positive for malaria infection. Species wise analysis shows that high infection rate was observed with P. vivax 22.6%, while the P. falciparum was observed in 3.04% population and mixed infection was recorded in 1.46% cases. No case of P. malariae and P. ovale were investigated.

Table 1. Prevalence of malaria infection in different locations of Pakistan (2000-2014)

S. No.	Study area	Prevalence	P. vivax	P. falciparum	Mixed species	References
1	Lal Qilla, District Dir (Lower)	29	97	3	-	Hussain et al., 2014
2	Mithakhel District Karak	83.33	-	-	-	Daud et al., 2014
3	District Panjgur	38.3	79.6	20.3	-	Yasinzai and Kakarsulemankhel, 2013
4	Pakistan	*801	76	18	6	Khattak et al., 2013
5	Bannu District	27.1	22.6	3.04	1.46	Khan et al., 2013a
6	Lal Qilla, District Dir (Lower)	17.32	99.47	0.53	-	Ahmad et al., 2013
7	Khyber Pakhtunkhwa	1.95	0.48	1.46	-	Khan et al., 2013b
8	Urban and Rural areas of Bannu district	17.35	91.53	7.47	-	Khan et al., 2013c
9	Quetta	18.45	81.66	18.34	-	Tareen et al., 2012
10	Bannu District	3.61	3.61	-	-	Awan et al., 2012
11	Children Hospital Chandka Medical College Larkana	36.5	41.09	58.9	-	Junejo et al., 2012
12	Shorkot Garrison		73.5	21.5	5	Asif, 2011
13	Department of Medicine, LUMHS, Jamshoro/Hyderabad	*200	46.5	52.5	-	Shaikh et al., 2011
14	Liaquat University Hospital Hyderabad, Sindh	89	52	48	-	Uttra et al., 2010
15	District Malaria Control Centre Jacobabad	0.91	71.48	28.52	-	Soomro et al., 2010a
16	Larkano District	1.68	47.15	52.85	-	Soomro et al., 2010b
17	Department of medicine at Liaquat University Hospital Hyderabad	81	47	53	-	Devrajani et al., 2009

18	Central Balochistan District Bolan	39.04	86.2	13.7	-	Yasinzai and Kakarsulemankhel, 2009a
19	District Ziarat and Sanjavi	26.8	30.2	69.5	-	Yasinzai and Kakarsulemankhel, 2009b
20	Sindh province	2.83	58.97	41.03	-	Murtaza et al., 2009
21	Barkhan and Kohlu	32.78	47.12	52.87	-	Yasinzai and Kakarsulemankhel, 2008a
22	Zhob district	41.8	51.8	48.1	-	Yasinzai and Kakarsulemankhel, 2008b
23	District Kharan	43.44	88.69	11.3	-	Yasinzai and Kakarsulemankhel, 2008c
24	Harnai, Duki and Sibi	34.2	57.1	42.8	-	Yasinzai and Kakarsulemankhel, 2008d
25	CMH Khuzdar	*505	24	69	7	Farooq et al., 2008
26	District Dera Murad Jamli	40.4	71.7	28.2	-	Yasinzai and Kakarsulemankhel, 2008e
27	Ayub Teaching Hospital Abbotabad	7.2	72.4	24.1	3.44	Idris et al., 2007
28	Qilla-Abdullah	-	62.2	37.7	-	Yasinzai and Kakarsulemankhel, 2007a
29	Central area of Balochistan	26.64	62.5	37.5	-	Yasinzai and Kakarsulemankhel, 2007b
30	Districts of Sindh	2.41	-	-	-	Nizamani et al., 2006
31	Private Clinic at Mansehra	96.25	92.21	7.79	-	Jalal-ud-din et al., 2006
32	Department of Medicine, Gomal Medical College, D. I. Khan	20	40.81	58.17	-	Khan et al., 2006
33	Balochistan province	14.21	-	-	-	Malaria Control Program, 2006
34	Balochistan province	8.98	-	-	-	Malaria Control Program, 2005
35	Quetta	34.85	66.87	30.72	2.39	Sheikh et al., 2005
36	Balochistan province	9.33	-	-	-	Malaria Control Program, 2004
37	Quetta	15.42	6.85	8.57	-	Yasinzai and Kakarsulemankhel, 2004
38	Rural area of Quetta district	16.25	5.55	10.70	-	Yasinzai and Kakarsulemankhel, 2003
39	Buner	6.86	5.78	1.08	-	Mohammad and Hussain, 2003
40	Children Hospital Baqai Medical University	*100	35	65	-	Akbar, 2002
41	Combined Military Hospital Zhob	11.77	-	-	-	Khadim, 2002
42	Muzaffarabad	-	6.33	0.6	-	Jan and Kiani, 2001
43	Rural Health Centre (RHC), Jhangara	5.9	35	65	-	Hozhabri et al., 2000

*The data was presented in table in the form of percentage. * Represent No. of total studied cases, positive/suspected cases. Prevalence rate of malaria was determined among the enrolled patients. Mixed species (P. vivax and P. falciparum).*

A malariometric population survey was conducted by Khattak et al. (Khattak et al., 2013) recorded the high prevalence of P. vivax followed by P. falciparum and mixed infection, 76%, 18% and 6% respectively. A study conducted by Ahmad et al. (Ahmad et al., 2013) reported 1091 cases of malaria from the general population of Lal Qilla Dir (Lower) in which 17.32%were positive for malaria. Out of positive cases 99.47% were found P. vivax and 0.53% was P. falciparum. No cases with P. malariae, P. ovale and mixed infection were observed. Khan et al. (Khan et al., 2013b) reported the overall prevalence of malaria was 1.95% among neonates in highly epidemic regions of Khyber Pakhtunkhwa. Out of the total positive cases, P. falciparum and P. vivax were reported 1.46% and 0.48% respectively. Similarly, another study carried out by Khan et al. (Khan et al., 2013c) notified overall malaria prevalence was 17.35%, with high No. of cases of P. vivax 91.53% than P. falciparum 7.47%. A study carried out by Awan et al. (Awan et al., 2012) from March to May 2002, among the student of religious School of Bannu District of Khyber Pakhtunkhwa reported that only 3.61% individuals were found positive for P. vivax. Tareen et al. (Tareen et al., 2012) conducted a study in Quetta investigated 18.45% cases of malaria in the human population. Species wise analysis shows that high infection was caused by P. vivax 81.66% and P. falciparum was 18.34%. No cases with P. malariae, P. ovale and mixed infection were observed. Junejo et al. (Junejo et al., 2012) reported 36.5% positivity rate of malaria at Children hospital Chandka Medical College Larkana from January 2008 to December 2008. Species wise distribution shows that P. falciparum was seen in 58.9% and P. vivax in 41.09. A study conducted by Asif, (Asif, 2011) reported 73.5% cases of P. vivax, 21.5% cases of P. falciparum and 5% cases of mixed infection from Shorkot Garrison. Shaikh et al. (Shaikh et al., 2011) notified maximum No. of cases of P. falciparum than P. vivax 52.5% and 46.5% respectively. According to Uttra et al. (Uttra et al., 2010), 89% were positive for malaria infection. Of the total positive cases, 52% investigated as P. vivax and 48% was identified as P. falciparum. Soomro et al. (Soomro et al., 2010a) conducted a study in District Malarial control Centre Jacobabad, a total of 58,989 blood smears were examined giving overall positivity rate of 0.915 (P. vivax 71.48% and P. falciparum 28.52%). The prevalence of malaria was noticed 1.68% among the febrile patients in District Larkano. P. falciparum and P. vivax were found with a ratio 1.1:1 (Soomro et al., 2010b) .

Devrajani et al. (Devrajani et al., 2009) conducted six-month hospital based cross-sectional study reported, 81% were found to be positive for malaria parasite with a high ratio of P. falciparum followed by P. vivax 53% and 47% respectively. Another study was carried out by Yasinzai and Kakarsulemankhel, (Yasinzai and Kakarsulemankhel, 2009a) at Central Balochistan District Bolan observed the ratio of infection with P. vivax were much higher 86.2% than P. falciparum 13.7%. The overall prevalence of malaria infection was 26.8% (P. falciparum 69.5% and P. vivax 30.2%) in District Ziarat and Sanjavi (Yasinzai and Kakarsulemankhel, 2009b). A study conducted by Murtaza et al. (Murtaza et al., 2009) at Sindh province of Pakistan during January 2002 to December 2006. In the study period, a total of 5843626 individuals were examined for the presence of malaria parasites. Of the total studied cases, 2.83% to be positive for malaria (P. vivax 58.97% and P. falciparum 41.03%). In this study, average blood examination rate was 4.46; annual parasite incidence was recorded 1.36.

A study was carried out by Yasinzai and Kakarsulemankhel, (Yasinzai and Kakarsulemankhel, 2008a) in the Barkhan and Kohlu bordering areas of east Balochistan, reported 3340 suspected cases of malaria. Out of total cases, 32.78% were positive for malaria infection (P. falciparum 52.87% and P. vivax 47.12%). The area wise analysis shows that P. falciparum infection was found high in Barkhan area as compare to P. vivax 60.88% and 39.11% respectively. In Kohlu area infection with P. vivax was reported high 58.91% while P. falciparum was 41.08%. No mixed infection and no case of P. malariae and P. ovale were seen. The increase in the P. falciparum and P. vivax infection shows a significant health hazard. However another study was carried out by Yasinzai and Kakarsulemankhel, (Yasinzai and Kakarsulemankhel, 2008b) in Zhob district, investigated high rate of malaria infection 41.8% in a local population of the said area. Species wise distribution shows that 51.8% cases of P. vivax and 48.1% cases of P. falciparum were reported.

Yasinzai and Kakarsulemankhel, (Yasinzai and Kakarsulemankhel, 2008c) reported high rate 43.44% of malaria infection in District Kharan. Of the total positive cases, P. vivax were with the highest ratio 88.69% as compare to P. falciparum 11.30%. However,

no mixed infection, P. malariae and P. ovale were not investigated in the current study. Yasinzai and Kakarsulemankhel, (Yasinzai and Kakarsulemankhel, 2008d) carried out another study in the in hottest areas of central Balochistan includes Harnai, Duki and Sibi. The overall result shows that 34.2% populations were infected with malaria infection. P. falciparum was observed high compared to P. vivax 57.1% and 42.8%. The area wise analysis shows that P. falciparum was reported high in Duki and Harnai where the P. vivax was found high in Sibi. No cases with P. malariae and P. ovale were seen, and no mixed infection was investigated.

A study was carried out by Farooq et al. (Farooq et al., 2008) at CMH Khuzdar (Balochistan) observed 69% cases of P. falciparum, 24% cases of P. vivax and 7% cases of mixed infection. However, no cases of P. malariae and P. ovale were investigated. Another study shows high 40.4% prevalence rate of malaria infection in District Dera Murad Jamli. Out of total positive cases, 71.7% were observed as P. vivax and 28.2% as P. falciparum. No case of P. malariae, P. ovale and mixed infection were reported (Yasinzai and Kakarsulemankhel, 2008e). Idris et al. (Idris et al., 2007) conducted a study at Ayub Teaching Hospital Abbotabad recorded 7.27% positivity rate of malaria among the studied individuals. P. vivax was observed in 72.4% followed by P. falciparum 24.1% and mixed infection 3.44%. Another study carried out by Yasinzai and Kakarsulemankhel, (Yasinzai and Kakarsulemankhel, 2007a) in Qilla-Abdullah recorded high rate of infection with P. vivax as compare to P. falciparum 62.2% and 37.7% respectively. Yasinzai and Kakarsulemankhel, (Yasinzai and Kakarsulemankhel, 2007b) conducted a study in the central area of Balochistan. Out of total suspected cases, 26.64% were found positive for malaria infection, the overall prevalence shows that P. vivax was observed high 62.5% than P. falciparum 37.5%. The species wise distribution in the selected area shows that 52.6% cases of P. vivax and 47.3% cases of P. falciparum were reported from Mastung, while 69.8% P. vivax and 30.1% P. falciparum cases were reported from Khuzdar area of Balochistan.

Nizamani et al. (Nizamani et al., 2006) reported an average slide positivity rate of 2.41% in many districts of Sindh. Infection with P. falciparum was reported 33% in 2004, with increase 37.2% in 2005. Similarly, another study undertaken by Jalal-ud-din et al. (Jalal-ud-din et al, 2006) at a private clinic in Mansehra screened 160 cases of malaria children in which 96.25% to be positive for malaria. They also reported 92.21% cases of P. vivax and only 7.79% cases of P. falciparum. Khan et al. (Khan et al., 2006) reported the overall prevalence of malaria was 20% (P. vivax 40.81% and P. falciparum 58.17%). According to a report of Malaria Control Program Balochistan, (2006), high slide positivity rate of malaria infection were observed in Kohlu 42.2% followed by Zhob 29.5%, Mastung 17.5%, Turbat 12.9%, Kharan 7%, Sibi 6.8%, Lasbella 5.7%, Qilla Abdullah 3.8% and Khuzdar 2.5.

In 2005, the high slide positivity rate of malaria infection was recorded from Zhob 32.4% followed by Turbat 13.5%, Kohlu 12.9%, Kharan 10.2%, Sibi 7.5%, Mastung 6.6%, Lasbella 4.7%, Khuzdar 1.5% and Qilla Abdullah 0.5% (Malaria Control Program, 2005). Sheikh et al. (Sheikh et al., 2005) conducted a study in Quetta recorded 34.85% positivity rate, while infection with P. vivax was to be noted high compared to P. falciparum 66.8% and 30.7% respectively. Malaria control program Balochistan, (Malaria Control Programme, 2004) investigated high slide positivity rate of malaria in Zhob 27.2% followed by Turbat 13.5, Kharan 13.3%, Kohlu 9.6%, Sibi 7.3%, Lasbella 5.7%, Mastung 5.3%, Khuzdar 1.1% and Qilla Abdullah 1%. Form Quetta the prevalence rate of malaria was recorded 15.42%, infection with P. falciparum are high 8.57% as compared to P. vivax 6.85% (Yasinzai and Kakarsulemankhel, 2004).

A survey was conducted by Yasinzai and Kakarsulemankhel, (Yasinzai and Kakarsulemankhel, 2003) during the period December 2000 to December 2002 at rural area of Quetta district. The overall prevalence was notified to be 16.25%, with more cases of P. falciparum than P. vivax 10.70% and 5.55% respectively. Mohammad and Hussain, (Muhammad and Hussain, 2003) observed 6.86% positive cases of malaria in general population of Buner. P. vivax was notified high 5.78% than P. falciparum 1.08%. Akbar,(Akbar, 2002) reported a high incidence of P. falciparum 65% as compare to P. vivax 35%. Khadim, (Khadim, 2002) reported 11.77% prevalence rate of malaria infection at Combined Military Hospital Zhob. Similarly, Jan and Kiani, (Jan and Kiani, 2001) reported high cases of P. vivax infection as compare to P. falciparum 6.33% and 0.6% respectively from Muzaffarabad. The prevalence of malaria was found to be 5.9% of febrile patients in Jhangara Sindh with a median age range of 24 months, with 35% cases of P. vivax and 65% of P. falciparum (Hozhabri et al., 2002).

Malaria is considered as the second most frequently recorded disease from human. In Indo-Pakistan, P. vivax and P. falciparum are common malaria species. Pakistan is the moderately endemic country for malaria. However, the prevalence of malaria was different from province to province and area to area. The province of Punjab which constitutes 52% of the national population, Sindh 25% and Baluchistan 5% population, alternatively contributes less than 10%, about 30% and over 30% cases of malaria respectively (Murtaza et al., 2009).

CONCLUSIONS

It was concluded from the study literature that P. vivax and P. falciparum are common malaria species present in Pakistan. Among the two species, P. vivax was found dominant than P. falciparum. The prevalence of malaria was different from province to province and area to area in the country. Preventive measurement, early case detection, proper treatment and awareness regarding disease should be an increase among the local inhabitant of Pakistan to get rid of malaria.

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Competing interests

The authors declare they have no competing interests.

References

Ahmad, T., Hussain, A and Ahmad, S. (2013). Epidemiology of Malaria in Lal Qilla. *International Journal of Technology and Scientific Research* 2(11): 199-202.

Akbar, J. U. (2002). Malaria in children at a Children Hospital. *J. Surg, Pak* 7(3): 20-22.

Anwar, M., Saleem, M and Zaheeruddin, M. (1994). Malaria: a challenge to meet. *Pakistan Armed Forces Med J* 44: 1–3.

Asif, N. (2011). Malaria in Shorkot garrison- a four years experience report. *Pakistan Journal of Pathology* 22(2): 58-64.

Awan, Z., Shah, H. T. A., Shah, A. H., Khan, M. A and Suleman, M. (2012). Malaria Among the Students of Religious Schools of Bannu District, Khyber Pakhtunkhwa, Pakistan. *Pakistan J. Zool* 44(4): 959-962.

Daud, M., Ullah, N., Khan, M and Ihsanullah. (2014). Prevalence of Malaria Cases in General Population of Mithakhel District Karak Pakistan. *Reviews of Progress* 2(7): 1-4; DOI: 10.9780/2321-3485/1322013/74.

Devrajani, B. R., Jaffery, M. H and Shah, S. Z. A. (2009). Spectrum of Malaria (Six months hospital based cross sectional descriptive study). *Medical Channel* 15(4): 30-33.

Farooq, M. A., Salamat, A and Iqbal, M. A. (2008). Malaria – An Experience at CMH Khuzdar (Balochistan). *Journal of the College of Physicians and Surgeons Pakistan* 18(4): 257-258.

Hozhabri, S., Akhtar, S., Rahbar, M and Lubi, S. (2000). Prevalence of plasmodium slide positivity among the children treated for malaria, Jhangara, Sindh. *J Pak Med Assoc* 50: 401-5.

Hussain, A., Ahmad, T., Ullah, N., Jadoon, M. A and Zohaib. (2014). Epidemiological Approach to Malaria: Plasmodium vivax is Common in Lal Qilla (Sub Division), Pakistan. *World Applied Sciences Journal* 30 (1): 29-31. DOI: 10.5829/idosi.wasj.2014.30.01.82268.

Idris, M., Sarwar, J and Fareed, J. (2007). Pattern of malaria infection diagnosed at Ayub Teaching Hospital Abbotabad. *J. Ayub Med. Coll* 19: 35-36.

Jalal-ud-din., Khan, S. A and Ally, S. H. (2006). Malaria in Children: Study of 160 cases at a Private Clinic in Mansehra. *J Ayub Med Coll Abbottabad* 18(3): 44-45.

Jan, A. H and Kiani, T. A. (2001). Haematozoan parasites in Kashmiri refugees. *Pak. J. Med. Res* 40: 10-12.

Junejo, A. A., Abbasi, K. A., Chand, H and Abbasi, S. (2012). Malaria in Children at Children Hospital Chandka Medical College Larkana. *Medical Channel* 18(1): 55-57.

Khadim, M. T. (2002). Malaria: a menace at Zhob Garrison. *Pak Armed Forces Med J* 52(2): 203-207.

Khan, H. U., Khattak, A. M., Khan, M. H., Mahsud, I. U and Humayun, S. (2006). A study of prevalence of malaria in adult population of D. I. Khan, Pakistan. *Biomedica* 22: 99-104.

Khan, I. U., Shah, A. H and Awan, Z. (2013c). Epidemiology of Malaria in Urban and Rural Areas of Bannu District Khyber Pakhtunkhwa, Pakistan. *International Journal of Modern Biology and Medicine* 4(1): 30-39.

Khan, S. H., Ayaz, S., Khan, S., Attaullah, S., Khan, M. A., Ullah, N., Khan, M. A and Ali, I. (2013a). Malaria: Still a Health

Problem in the General Population of Bannu District, Khyber Pakhtunkhwa, Pakistan. *Annual Review & Research in Biology* 3(4): 835-845.

Khan, S. N., Ayaz, S., Ali, I., Attaullah, S., Shams, S., Zareen, S., Khan, M. A., Rashid, F and Khan, S. (2013b). Burden of Malaria infection among Neonates in highly epidemic region of Khyber Pakhtunkhwa, Pakistan. *International Journal of Advancements in Research & Technology* 2(4): 84-92; ISSN 2278-7763.

Malaria Control Program (MCP). (2004). District-wise epidemiological data of malaria control program, Balochistan, Pakistan.

Malaria Control Program (MCP). (2005). District-wise epidemiological data of malaria control program, Balochistan, Pakistan.

Malaria Control Program (MCP). (2006). District-wise epidemiological data of malaria control program, Balochistan, Pakistan.

Mohammad, N and Hussain, A. (2003). Prevalence of malaria in general population of district Buner. *J. Pak. Med. Inst* 17(1): 75-80.

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. *Pak J Med Sci* 25(4): 646-649.

Nizamani, A., Kalar, N. A and Khushk, I. A. (2006). Burden of malaria in Sindh, Pakistan: a two years surveillance report. *J. Liaqat Uni. Med. Health Sci*5: 76-83.

Shaikh, M. A., Ahmed, S., Diju, I. U and Dur-E-Yakta. (2011). Platelet count in Malaria patients. *J Ayub Med Coll Abbottabad* 23(1): 143-145.

Sheikh, A. S., Sheikh, A. A., Sheikh, N. A and Paracha, S. M. (2005). Endemicity of malaria in Quetta. *Pakistan J. Med. Res* 44: 41- 45.

Soomro, F. R., Pathan, G. M., Bajaj, D and Kakar, J. K. (2010). Malarial parasites species; Jacobabad District Sindh, Pakistan. *Professional Med J* 17(3):440-443.

Soomro, F. R., Pathan, G. M., Gurbakhshani, A. L and Kakar, J. K. (2010). Prevalence of Malarial parasites in Larkano District, Sindh, Pakistan. *Gomal Journal of Medical Sciences* 8(2): 146-148.

Tareen, A. M., Rafique, M., Wadood, A., Qasim, M., Rahman, H., Shah, S. H., Khan, K and Pirkani, G. S. (2012). Malaria burden in human population of Quetta, Pakistan. *European Journal of Microbiology and Immunology* 2(3):201-204. DOI: 10.1556/EuJMI.2.2012.3.5.

Uttra, C. K. M., Devrajani, B. R., Shaikh, K., Shaik, K. R and Shah, S. Z. A. (2010). Severity of Thrombocytopenia and Prolonged Bleeding Time in Patients with Malaria (A Clinical Study of 162 Malaria Cases). *World Applied Science Journal* 9(5): 484-488.

Yasinzai, M. I and Kakarsulemankhel, J. K. (2003). Incidence of malaria infection in rural areas of District Quetta, Pakistan. *On Line J. Bio. Sci* 3(9): 766-772.

Yasinzai, M. I and Kakarsulemankhel, J. K. (2004). A study of prevalence of malaria infection in urban areas of district Quetta, Pakistan. *Pak. J. Zool* 36:75-79.

Yasinzai, M. I and Kakarsulemankhel, J. K. (2007a). Incidence of malaria infection in Pak-Afghan border area of Pakistan: District Qilla Abdullah-Chaman. *Hamdard Medicus*October-December, 50:62-66.

Yasinzai, M. I and Kakarsulemankhel, J. K. (2007b). Incidence of human malaria infection in central areas of Balochistan: Mastung and Khuzdar. *Rawal Med. J* 32: 176-178.

Yasinzai, M. I and Kakarsulemankhel, J. K. (2008a). Incidence of human malaria infection in bordering areas adjoining with Punjab: Barkhan and Kohlu. *Pak. J. Med. Sci* 24: 306-310.

Yasinzai, M. I and Kakarsulemankhel, J. K. (2008b). Incidence of human malaria infection in northern hilly region of Balochistan adjoining with NWFP, Pakistan: District Zhob. *Pak. J. Bio. Sci*11: 1620-1624.

Yasinzai, M. I and Kakarsulemankhel, J. K. (2008c). Incidence of malaria infection in desert area of Pakistan: district Kharan. *J. Agri. Soc. Sci* 4: 39-41.

Yasinzai, M. I and Kakarsulemankhel, J. K. (2008d). Frequency of various human malaria infections in hottest areas of central Balochistan, Pakistan: Duki, Harnai and Sibi. *Pak. Armed Forces Med J 58* (3):276-285.

Yasinzai, M. I and Kakarsulemankhel, J. K. (2008e). Prevalence of Human Malaria infection in Pakistan: District Dera Murad Jamali. *Pakistan Journal of Science* 60(3-4): 67-71.

Yasinzai, M. I and Kakarsulemankhel, J. K. (2009a). Incidence of human Malaria infection in Central Balochistan, Pakistan: District Bolan. *Biologia (Pakistan)* 55 (1&2): 43-50.

Yasinzai, M. I and Kakarsulemankhel, J. K. (2009b). Prevalence of Human Malria Infection in District Ziarat and Sanjavi, Pakistan. *Pakistan J. Zool* 41(6): 475-482.

Yasinzai, M. I and Kakarsulemankhel, J. K. (2013). Prevalence of human malaria infection in Pakistani areas bordering with Iran. *J Pak Med Assoc* 63(3): 313-316.

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