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Incidence of Human Malaria Infection in Northern Hilly Region of Balochistan, Adjoining with NWFP, Pakistan: District Zhob

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Abstract: This study was conducted to investigate the incidence of malarial infections in human population in 37 localities of district Zhob, Balochistan, Pakistan. Malarial parasites were identified in the blood slides of suspected patients of the disease from July, 2004 to June, 2006 and encompassed 7748 subjects. Out of 7748 suspected cases of malaria, 3240 (41.8%) were found to be positive for malarial parasite in blood smear slides. Out of positive cases, 1681 (51.8%) were identified as *Plasmodium vivax* infection and 1559 (48.1%) cases with *P. falciparum*. However, seasonal variation was also noted with the highest (85.4%: 141/165) infection of *P. vivax* in March and lowest (18.6%: 59/316) in October while infection of *P. falciparum* was highest (81.3%: 257/316) in October and lowest (14.5%: 24/165) in March. Infection with *P. vivax* in male was 75.7% (125/165) in March and in female 26.3% (58/220) in May whereas infection of *P. falciparum* in male was 61.5% (245/398) in July and in female was 20.5% (65/316) in October. These results are compared with those of other studies done in Pakistan. Cases of *P. malariae* and *P. ovale* were not found in the present study. In conclusion it can be pointed out that the high incidence rate of *P. vivax* (51.8%:1681/3240) in Zhob district poses a significant health hazard because it may also lead to cerebral malaria as it was suggested by previous workers.

Key words: Human malarial infection, *Plasmodium vivax*, *P. falciparum*, Zhob

INTRODUCTION

Malaria is one of the most devastating diseases in the World. Over 3 billion people live under the threat of malaria in 24 endemic countries (WHO/UNICEF, World Malaria Report, 2005) and it kills over a million each year- mostly children (Korenromp, 2004).

Falciparum and *vivax* malaria are major health problems in Pakistan. In the last decade there has been a six fold increase in falciparum malaria, which now comprises 42% of all malaria cases recorded by National Malaria Control Program (MCP) (Shah *et al*.,1997). Factors associated with the upsurge include of chloroquine resistance across the country (Shah *et al*., 1997), warmer autumns favoring prolonged transmission (Bouma *et al*., 1996) and a chronic decline in vector control activities. *Anopheles culicifacies*, the purported primary vector in the Punjab Province (Reisen and Borham, 1982) was found more or less disappeared by September whereas *A. stephensi* was found more abundant and more common in North-West Frontier Province than *A. culicifacies*. In Pakistan, the primary vector species are *A. culicifacies* and *A. stephensi* and in Quetta Balochistan also (Malaria Control Program, 1999, 2000; Yasinzai and Kakarsulemankhel, 2003).

In Pakistan, Hozhabri *et al.* (2002) studied prevalence of plasmodium slide positivity among the children treated for malaria at Rural Health Center (RHC) Jhangara, Sindh and observed slide positivity rate 5.9% (26/438). Bhalli and Samiullah (2001) investigated a review of 120 cases of falciparum malaria at CMH, Multan to evaluate seasonal variation and modes of presentation. They observed high incidence of falciparum malaria among troops in the moths of August to November. Akbar (2002) reported malaria at a children hospital Baqai Medical University and observed high incidence of *Falciparum* as compared to *vivax* (65 vs 35%). Mohammad and Hussain (2003) studied prevalence of malaria in general population of district Buner and highest rate of infection (11.6%) was recorded in August while the lowest rate of infection (3.9%) was noted in March. Malaria in pediatric age group of 200 cases was investigated by Jamal *et al.* (2005) and found high rate of *P. vivax* (62.5%) than *P. falciparum*. (36%). Nizamani *et al.* (2006) found that *P. falciparum* ratio was noted to be increasing in many districts of Sindh. Malaria in North West Frontier Province (NWFP) was studied by Saleem *et al.* (2006) and observed cerebral malaria more common in males and most vulnerable group was pregnant ladies. Jalaluddin *et al.* (2006) investigated malaria in children in Mansehra and observed 142 cases

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suffering from *vivax* and 12 from *falciparum* out of 160 cases. Idris *et al.* (2007) while studying pattern of malarial infection at Ayub Teaching Hospital Abbottabad found that out of 1994 patients screened, 145 (7.2%) were found infected. *P. vivax* was seen in the majority (72.4%) than *P. falciparum* (24.1%).

In Balochistan too, cerebral malaria is a major community problem. Nawaz and Yasmin(1987) studied the prevalence of malaria in Afghan refugees settled in urban areas of district Quetta. Durrani *et al.* (1997) studied epidemiology of cerebral malaria and its mortality in patients of Quetta city. Malaria at Zhob Garrison was studied by Khadim (2002) during the years 2000 and 2001 and found 665 patients positive for malaria out of 5650 cases. Yasinzai and Kakarsulemankhel (2003, 2004) investigated the incidence of malaria infection in urban and rural areas of Quetta district. Malaria Control Program (MCP) Balochistan in its yearly reports showed positivity rate 10.1%, *P. vivax* 6.6%, *P. falciparum* 3.5, 11.2, 6.6, 4.6 and 12.7, 8.2, 4.4% in 2004, 2005 and 2006, respectively (Malaria Control Program, 2004, 2005, 2006). Sheikh *et al.* (2005) observed slide positivity 34.8% (91679/2, 63, 018) in Quetta during 1994-1998. While studying malaria in central areas of Balochistan (Mastung, Khuzdar districts), Yasinzai and Kakarsulemankhel (2007) observed 2092 (26.6%) confirmed cases of malaria out of 7852 in the year 2004-2006. In Zhob district where malaria cases are seen throughout the year according to Khadim (2002) who studied malaria cases of Zhob Garrison reported at Combined Military Hospital (CMH) Zhob which does not represent the situation of malaria in the whole district. Therefore, in the present study the incidence of malaria in the whole district comprising 37 localities along with seasonal variation of the disease has been investigated.

MATERIALS AND METHODS

A survey was conducted during July, 2004 to June, 2006 in 37 localities of district of Zhob to record and screen species of malarial parasites from the blood of human patients suffering from malaria.

Location: District Zhob (Lat. 30°, Long. 68°, Height 1410 m) is situated at the north-eastern border of Balochistan province adjoining in the west with Afghanistan and in the east with Dera Ismail Khan area of the NWFP (Pakistan) where cases of human malaria are very frequent.

Malaria cases were detected by adapting two ways (Manson-Bahr and Bell, 1987). Passive Case Detection (PCD) technique where in blood films were taken from the patients presenting themselves to a health station with symptoms of shivering and fever or a history suggestive to malaria. The other technique is Active Case Detection (ACD) in which home visits were made to the persons with sign or symptoms of malaria and blood films of both thin and thick were prepared. Blood slides were taken back to the laboratory where they were stained in Giemsa's stain following the techniques described by Manson-Bahr and Bell (1987). Identification of species of malarial parasites were made from the keys furnished by Service (1986) and Sood (1989). Statistical analysis of the data (Chi-square test) on the overall incidence of malaria infection was also applied.

RESULTS

A total of 7748 blood smears were prepared from the age groups ranging from 1 year to 21 years and above, residing in different localities of Zhob (Table 1-4). However, variations of infection with *P. vivax*

Table 1: Area and over all incidence of malaria infection in Zhob district

Area	No. of slides examined	Total No. of +ve	No. of +ve *P. vivax* (%)	Species wise *P. falciparum* (%)
Zhob City	937	381	173 (45.41)	208 (54.59)
Mena Bazar	509	177	94 (53.11)	83 (46.89)
Killi Takai	483	175	86 (49.14)	89 (50.86)
Manikhawa	347	142	68 (47.89)	74 (52.11)
Wallakram	497	204	97 (47.55)	107 (52.45)
Maloor	571	137	79 (57.66)	58 (42.34)
Badinzai	277	129	85 (65.89)	44 (34.11)
Killa Sherak	206	95	40 (42.11)	55 (57.89)
Gudra Balar	190	71	31 (43.66)	40 (56.34)
Killi Apozai	248	97	46 (47.42)	51 (52.58)
Tora Drugha	269	128	84 (65.63)	44 (34.38)
Kharotabad	321	147	88 (59.86)	59 (40.14)
Shahabzai	216	91	35 (38.46)	56 (61.54)
Murgha Kibzai	319	144	62 (43.06)	82 (56.94)
Nasarabad	269	127	88 (69.29)	39 (30.71)
Soora	81	33	11 (33.33)	22 (66.67)
Sangar	63	36	29 (80.56)	7 (19.44)
Aronari	87	45	20 (44.44)	25 (55.56)
Dargai	99	62	27 (43.55)	35 (56.45)
Thadozai	143	82	39 (47.56)	43 (52.44)
Killibrunj	152	66	37 (56.06)	29 (43.94)
Harifalabad	149	74	38 (51.35)	36 (48.65)
Sabakzai	85	34	22 (64.71)	12 (35.29)
Shiranibazar	138	71	60 (84.51)	11 (15.49)
Miralikhel	74	33	17 (51.52)	16 (48.48)
Khosti	69	38	24 (63.16)	14 (36.84)
Lakaband	128	63	35 (55.55)	28 (44.44)
Tangsar	70	39	26 (66.67)	13 (33.33)
Qamardin Karez	73	29	12 (41.38)	17 (58.62)
Sambazah	132	64	20 (31.25)	44 (68.75)
Alikhanzai	69	35	10 (28.57)	25 (71.43)
Killishaikhan	139	51	24 (47.06)	27 (52.94)
Surkach	61	22	9 (40.91)	13 (59.09)
Ghoosa	57	24	13 (54.17)	11 (45.83)
Omazha	74	29	17 (58.62)	12 (41.38)
Shinghar	88	34	16 (47.06)	18 (52.94)
Shaghalo	58	31	19 (61.90)	12 (38.71)

Table 2: Month wise and over all incidence of malaria infection in Zhob district

Month (2004-2006)	No. of slides Examined	Total No. of +ve	*P. vivax* (%)	*P. falciparum* (%)
July, 2004	930	398	140 (35.17)	258 (64.82)
August,	649	281	110 (39.14)	171 (60.85)
September	734	328	128 (39.02)	200 (60.97)
October	764	316	59 (18.67)	257 (81.33)
November	703	280	186 (66.43)	94 (33.57)
December	748	297	202 (68.01)	95 (31.99)
January	374	134	85 (63.43)	49 (36.57)
February	247	75	62 (82.67)	13 (17.33)
March	442	165	141 (85.45)	24 (14.54)
April	569	224	187 (83.48)	37 (16.52)
May	525	220	167 (75.91)	53 (24.09)
June, 2006	1063	522	214 (41.00)	308 (59.00)
Total	7748	3240	1681 (51.88)	1559 (48.12)

Table 3A: Age-wise over all incidence of malaria infection in Zhob district

Age (years)	No. of slides examined	Total No. of +ve	Over all % infection	Infection by *P. vivax* (%)	Infection by *P. falciparum* (%)
1-10	2809	1219	43.40	644 (52.83)	575 (47.17)
11-20	2510	1047	41.71	553 (52.82)	494 (47.18)
21-above	2429	974	40.10	484 (49.69)	490 (50.31)
Total	7748	3240	41.82	1681 (51.88)	1559 (48.12)

Table 3B: Statistical analysis of Table 3A age-wise over all incidence of malaria infection in Zhob district

	Types of infection				
	A		B		
Age (years)	(fo)	(fe)	(fo)	(fe)	Total
1-10	644	632.45	575	586.55	1219
11-20	553	543.21	494	503.79	1047
21 above	484	505.34	490	468.66	974
Total	1681		1559		3240

$$X^2_{cal} = \Sigma \frac{(fo - fe)^2}{fe} = 2.67791$$

fo = 1st and 2nd column show the incidence rate of *P. vivax* and *P. falciparum*, respectively. fe = 1st and 2nd column show the % of infection of both the columns

Table 4: Month and sex wise incidence of malaria infection in Zhob district

Month (2004-2005)	No. of slides examined	Total No. of +ve	Male		Female	
			P.v.	P.f.	P.v.	P.f.
July, 2004	930	398	98	245	42	13
August	649	281	82	139	28	32
September	734	328	93	137	35	63
October	764	316	47	192	12	65
November	703	280	145	65	41	29
December	748	297	163	78	39	17
January	374	134	74	46	11	3
February	247	75	55	12	7	1
March	442	165	125	21	16	3
April	569	224	162	30	25	7
May	525	220	109	40	58	13
June	1063	522	150	206	64	102

and *P. falciparum* were observed among different localities having different hygienic conditions.

In Zhob district (Table 1-4), the over all incidence of Plasmodium slide positivity was 41.8% (3240/7748), wherein *P. vivax* was observed to be highest (51.8%: 1681/3240) as compared with that of *P. falciparum* (48.1%: 1559/3240). Among children of the age group 1-10 years, *P. vivax* was observed higher (52.8%:644/1219) than *P. falciparum* (47.1%: 575/1219). Similarly, in the age group of 11-20 years, *P. vivax* was found more (52.8%: 553/1047) than *P. falciparum* (47.1%:494/1047). Whereas in the age group of 21 years and above, *P. falciparum* was found higher (50.3%:490/974) than *P. vivax* (49.6% (484/974). Seasonal variation was also noted. The highest infection of *P. vivax* (85.4%:141/165) was noted in March and lowest 18.6%:59/316) in October while *P. falciparum* was highest (81.3%: 257/316) in October and lowest (14.5%: 24/165) in March. Sex wise ratio was also noted. Male to female ratio was 3.4:1 (2514:726).

Table 1-4 were statistically analyzed to test whether there is any association between types of infection and age groups through χ^2 at 5% level of significance, χ^2 calculated as 2.67791 (Table 3B) and compared with the table value of $\chi^2 = 5.991$. Since calculated value of χ^2 is less than the table value so it is concluded that there is no association between types of infection and age groups.

DISCUSSION

Malaria affects an estimated 300 million people and causes more than a million deaths per year worldwide. Falciparum malaria has high mortality as it causes complications like cerebral malaria, renal failure and algid malaria (Bhalli and Samiullah, 2001).

In present study, the incidence of *P. vivax* was observed to be higher (51.8%: 1681/3240) as compared with that of *P. falciparum* (48.1%: 1559/3240). Similarly, Yar *et al.* (1998) while studying prevalence of malarial parasite species in Multan district, observed high incidence of *P. vivax* (60.5%) and a low incidence of *P. falciparum* (37.2%) with slide positivity rate 17.2%. Similarly, Jan and Kiani (2001) while studying malarial parasites in Kashmiri refugees settled in Muzaffarabad reported high incidence (6.3%) of *P. vivax* than of *P. falciparum* (0.6%) with slide positivity rate 7%. Mohammad and Hussain (2003) observed high incidence of *P. vivax* (5.7%) and 1% *P. falciparum* infection among the general population of district Buner. Sheikh *et al.* (2005) reported high rate of *P. vivax* (66.8%: 61313/91679) than *P. falciparum* (30.7%: 28166/91679). Jalaluddin *et al.* (2006) studied 160 cases of children at a private clinic in Mansehra (NWFP) and found slide positivity rate 96.2% and *P. vivax* was noted to be higher (92.2%) than *P. falciparum* (7.7%). In Iran south east of Caspian sea, Zarchi *et al.* (2006) observed slide positivity rate 9.6% and *P. vivax* was found higher (61%) than *P. falciparum*

(20.7%). Idris *et al.* (2007) investigated malaria infection at Ayub Teaching Hospital Abbottabad and observed slide positivity rate 7.2% and *P. vivax* was found higher (72.4%) than *P. falciparum* (24.1%). Similarly, Yasinzai and Kakarsulemankhel (2007) studied incidence of malaria infection in central areas of Balochistan (Mastung and Khuzdar) and found over all slide positivity rate 26.6% and *P. vivax* was observed higher (62.5%) than *P. falciparum* (37.4%).

However, mixed infection of *P. vivax* and *P. falciparum* was not observed in the present study, as mixed infection of 2.3% was observed in Multan district by Yar *et al.* (1998). Zarchi *et al.* (2006) and Idris *et al.* (2007) also observed mixed infection 18.3 and 3.4%, respectively in Iran and Abbottabad. During present study, *P. malariae* and *P. ovale* infection was not seen in any patient as the same was also not observed by Yar *et al.* (1998) in Multan and Idris *et al.* (2007) in Abbottabad. High rate of *P. vivax* (51.8%:1681/3240) was not only observed in our study, but observed in previous above mentioned studies also really poses an alarming health hazard in the country as it may lead to cerebral malaria as it was pointed out by Abbasi and Shaikh (1997) that recently World Health Organization has reported the occurrence of cerebral malaria also due to the *P. vivax*.

In spite of malaria control program, it still remains a great challenge. Keeping in view the results of the present investigation, Directorate of Malaria Control Program (MCP) Balochistan, should effectively arrange malaria control program. A joint effort in this regard is to be organized by Health Department, Irrigation Department and Local Government to eradicate the favorable epidemiological factors, which promote the spread of malaria, so as to ensure the public health of the inhabitants of mentioned areas.

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